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FAINT PRAISE: THE DEVELOPMENT OF
AMERICAN TANKS AND TANK DESTROYERS
DURING WORLD WAR II

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Dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of
Philosophy in the Department of
History in the Graduate School
of Duke University

1977

ABSTRACT
(History-Modern)

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ABSTRACT

The purpose of this study was to find out why the United States Army did not have a better tank than the Sherman (M4) during World War II. The three official histories of the Ordnance Department have answered that question for most authors concerned with the topic. A close examination of their sources, and others, forced this author to disagree with their conclusions. More importantly, the research for this paper revealed a far more complicated story than the one in the official histories.

The problem of American tank development during the war was a mixture of doctrine, intelligence, personalities, and technology. The main reason for criticism of the Sherman was its inability to defeat German tanks, specifically the Panther and Tiger. But the Sherman was not designed or intended to vanquish other tanks. That mission, according to American doctrine, belonged to the tank destroyers. As background, this study explains tank destroyer doctrine, why it was adopted, and how what amounted to a new combat arm was created during the war. The study also tries to explain why tank destroyer doctrine was not used in combat.

Both American tanks and tank destroyers ultimately proved inadequate to deal with Panthers and Tigers. This was due to the failure of technical intelligence to reveal the inadequacy of American guns before July 1944. Despite accurate and timely data

about German tanks, the scientists of the Ordnance Department had grossly overestimated the ability of American guns to deal with them, and technology could not provide an immediate solution.

A basic fact of technological development was that it required time. Months or years were needed to build a new armored vehicle--or even arm it with a better gun. A problem revealed in 1944 was one that could not be solved until 1945 at best. The Ordnance Department's answer to the German tanks, the Pershing (M26), took three years from inception to battle. General Lesley J. McNair, overruled by General George C. Marshall on the question of producing the tank, did not delay production by a single day.

The intermittent involvement of important personalities in the development of both doctrine and equipment was an important part of the story, revealing their attitudes toward both. More important, they decisively altered the paths of development.

Sources for the study were primarily from records of various Army agencies, now held by the National Archives. The only new source was the collection of Andrew D. Bruce's papers, first commander of the tank destroyers, at the Military History Research Center at Carlisle Barracks, Pennsylvania. Published works provided background.

The results of the study indicate that the US Army was not attuned to technological development. Opinions, not reasoned analysis supported by available data, governed decisions. The decision process was replete with examples of muddles, blunders, buck-passing, and technological pitfalls. Still, America managed to produce, in the face of tremendous industrial and technological

problems, a large number of effective armored combat vehicles in a respectably short time. But American soldiers lost their lives because those vehicles were not adequate to the task found in Northwest Europe in 1944-1945.

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C.M.B.

CHAPTER I

INTRODUCTION

A Bronx Cheer comes out of Germany to greet the news that the Pershing tank has gone into mass production. It is the opinion of the men at the front, apparently, that they will get the new tank in numbers when it is no longer needed, i.e. when the war is over...an investigation is thoroughly in order. It should take up the reasons for the long delay in getting the Pershing in production. It should likewise find out why our tanks are inferior to the enemy's.¹

This comment from the Washington Post is typical of press criticism of United States tanks during the first months of 1945. The Battle of the Bulge, bitterly fought during December 1944 and January 1945, had exposed serious deficiencies in the American tank's ability to deal with the heavier German Panzers. Correspondents heard the angry voices of the G.I.'s and began berating the War Department for its failure to provide the Pershing (M26) sooner.

Hanson Baldwin, military editor of the New York Times and one of America's most respected commentators on military affairs, had opened the dispute in the New York Times on 5 January 1945.²

¹Washington Post, 22 March 1945, p. 2, quoted by Constance McLaughlin Green, The Ordnance Department: Planning Munitions for War (Washington, D.C.: OCMH, 1955), p. 276.

²Hanson W. Baldwin, "New German Tanks Prove Superior to Ours-- Inquiry by Congress Urged," New York Times, 5 January 1945, p. 4.

2

He pointed out the demonstrated inferiority of the United States Sherman tank in duels with heavy German tanks such as the Hunting Panther (Jagdpanther) and Royal Tiger (Tiger II) and saw Army conservatism as the cause of the failure to produce better tanks. Baldwin could see no reason why the Germans were ahead of the United States in tank quality and urged Congress to investigate the situation.

Newsweek magazine echoed Baldwin's charges in a series of articles in early 1945. In January, with perfect hindsight, Newsweek claimed to have seen the problem in 1943. Newsweek used the Tiger II as the basis for comparing German and American tanks. Sensational quotations such as ".../American tanks were/ not worth a drop of water on a hot stove..." kept the controversy on the pages of Newsweek until March 1945.¹

Of course, such criticism soon brought responses from the Army. Typical of these rebuttals was a letter from Lt. Gen. George S. Patton, Jr. to Maj. Gen. Thomas T. Handy, Assistant Chief of Staff, which was published for public consumption. High German tank losses in comparison to Third Army tanks lost, Patton argued, refuted any claims that United States tanks were inferior. Further, Patton commented that if the Armored Divisions of the Third Army had been equipped with the notoriously unreliable Tiger tanks they would have lost all of their tanks due to breakdowns by the time they reached the Moselle River. In fact, the reliable American tanks had suffered few such losses.²

¹"Decision to the Tiger," Newsweek, 15 January 1945, p. 26; "Must We Defeat Germany with Inferior Weapons," Newsweek, 26 February 1945, p. 28; and "Chasing the Tiger," Newsweek, 19 March 1945, p. 33.

²Letter from Lt. Gen. George S. Patton, Jr. to General Thomas T. Handy, dtd. 19 March 1945, quoted in Army Ordnance, May-June, 1945, p. 428.

Press criticism died in the spring of 1945. The slogging, winter battles to the Rhine crossings which had shown United States tanks at their worst were replaced by swift advances that displayed them at their best. The press rapidly lost interest in the quality of tanks. The reasons for the late deployment of new tanks became military history rather than news.

Perhaps the first word of what would become the prevailing interpretation of tank development came from Col. Joseph M. Colby, wartime Developments Director of the Tank-Automotive Command at Detroit, Michigan. Writing in September 1945, Colby noted that the theme "We'll win the war with the M4" had hampered tank development.¹

In a 1950 magazine article, just before the outbreak of the Korean War, Colby condemned the War Department for not ordering production of various tanks developed by the Ordnance Department which he claimed were far superior to the Sherman.² Included in those ill-fated tanks was the T20E3 which, Colby claimed, was released for production in August 1942. Colonel Colby's memory was faulty by 1950. Ordnance records indicate that the T20E3 was nowhere near being ready to enter mass production in 1942.³

¹Col. Joseph M. Colby, "Contributions of Industry to Ordnance Tank-Automotive Engineering," S.A.E. Journal, September 1945, p. 535.

²Col. Joseph M. Colby, "From Designer to Fighter," Armor, January-February 1950, p. 14.

³"Chronology," History of the T20 Tank (hereafter cited as T20 Hist.), Ordnance Historical File (hereafter cited as OHF), Entries for 5, 14, 18, 27, and 31 August 1942. The T20 Hist. is a bound collection of documents in the OHF. The Chronology is part of the T20 Hist. and can best be described as an office journal of the Research and Development Division of the Ordnance Department and is the best available source for day to day activities of the R&D Division concerning the T20 tank series. Hereafter, references to the Chronology will be T20 Chron. followed by the entry date, e.g. T20 Chron., 5 August 1942.

Further, the record shows that Colby called Maj. Gen. Gladeon M. Barnes, Chief of Research and Development for the Ordnance Department on 15 August 1943, to recommend dropping the T20E3 in favor of another tank because, as he put it, "They can't keep transmissions running in the T20E3."¹

The idea that the Ordnance Department was not to blame for the deficiencies of American tanks gained the support of official historical scholarship with the publication of the three histories of the Ordnance Department. The first of these, The Ordnance Department: Planning Munitions for War (1955) by Constance McLaughlin Green placed the blame for poor tanks on Army Ground Forces (AGF) and its commander, Lt. Gen. Lesley J. McNair. She agreed with Colby about the T20E3 and used his article as her source. In her long argument, Green admitted that the Armored Force was involved in the controversy but placed most of the blame on AGF and McNair.²

Continuing the same arguments, Harry C. Thomson and Lida Mayo cited opposition to the M26 from AGF in The Ordnance Department: Procurement and Supply (1960). Again, the authors did not fully exploit the official records. Thomson and Mayo claimed that the Ordnance Department did not win approval for mounting the 90-mm gun in the T26 (experimental version of the M26) until June 1944.³ But records of the Ordnance Department showed clearly

¹T20 Chron. 15 August 1943.

²Green, Planning, pp. 237, 282-284.

³Harry C. Thomson and Lida Mayo, The Ordnance Department: Procurement and Supply (Washington, D.C.: OCMH, 1960), p. 21.

that the 90-mm gun for the T26 was approved in May 1943.¹

The last of the official histories, The Ordnance Department: On Beachhead and Battlefront (1968) by Lida Mayo, was the least biased. She admitted that the Ordnance Department might have been less than wise in failing to attempt mounting the 90-mm gun in the Sherman tank and thus getting that weapon into the combat zones much sooner. While Mayo's work had more detail than its predecessor's it still tended to bias the arguments between the Armored Force, AGF, and the Ordnance Department in favor of the latter. For example, she stated that Army Service Forces (ASF) did not approve production of 250 T26's until January 1944 while War Department records show that the War Department directed production of those tanks in December 1943.²

Despite these errors, the official histories have become the standard interpretation of the controversy over wartime tank development. Historians of armor such as Peter Chamberlain and Chris Ellis, British and American Tanks of World War II, and R.P. Hunnicutt, Pershing: A History of the Medium Tank T20 Series, repeated the theme of the official histories, while Russel F. Weigley reproduces the position of the Ordnance Department in his

¹T20 Chron., 5 May 1943.

²Lida Mayo, The Ordnance Department: On Beachhead and Battlefront (Washington, D.C.: OCMH, 1968), p. 330 and memo for Commanding General ASF from Asst. Chief of Staff, G-4, dtd. 16 December 1943, in G-4 Decimal File (G-4 of the War Department), file no. 470.8, RG 165, National Archives (hereafter cited as G-4 followed by the file no, e.g. G-4 (470.8)).

History of the United States Army.¹

Given the errors of the official histories, another examination of tank development in America during World War II seems worthwhile. More important, the official histories ignored many of the factors that influenced the development of tanks. The controversy over the development of armored vehicles was far more complicated than a simple argument between three Army agencies in the United States.

One of the important reasons why the United States Army continued to fight the war with the Sherman tank was because the units in combat were satisfied with that tank until late in the war. Their complacency was undisturbed by combat experience. Technical intelligence, a function of the Ordnance Department, failed to compensate for this lack of experience by revealing the technological threat posed by the increasingly numerous, heavy German tanks that would face American soldiers in 1944. The official historians paid little attention to the impact that opinions from the combat zones made on tank development, particularly during 1942-1943 when there was still time for major changes. As a result of these factors, there was no great demand for a better tank than the Sherman until the last months of the war in Europe.

This fact highlights what is perhaps the single most important factor concerning tank development--time. It takes years to

¹Peter Chamberlain and Chris Ellis, British and American Tanks of World War II (New York: Arco Pub. Co., 1969), pp. 151 and 158; R.P. Hunnicutt, Pershing: A History of the Medium Tank T20 Series (Berkeley, Calif.: Feist Pub., 1971), pp. 194-195; and Russel F. Weigley, History of the United States Army (New York: Macmillan Co., 1967), pp. 472-473.

design and then produce any major item of military hardware such as a tank or howitzer. When the leaders of the United States Army realized during the summer of 1944 that the capabilities of German tanks were a significant tactical problem, it was far too late for a new, technological solution. Only equipment already under development or in production would be available in time to be of any use.

While time was the relentless arbiter of technological development everywhere, in the United States the Army's unique doctrine was also a major factor. Sherman tanks were later condemned for their inability to destroy German tanks. But they were not designed or intended to accomplish that task as a primary mission. The task of antitank warfare in the United States Army belonged to the Tank Destroyers, and their development was intertwined with that of tanks.

The basis for the criticism of American tanks was their firepower, in particular the inability of their firepower to deal with German tanks. Firepower was also the main issue linking tanks and tank destroyers. When a need appeared for better anti-tank guns, US Army doctrine represented by AGF called for these weapons to be mounted primarily in tank destroyers because tank-killing was only a secondary requirement for tank guns.

The US Army did not expect its tanks to get into slugging matches with other tanks. According to Army doctrine, "The most profitable role of the armored division is exploitation."¹

¹U.S. War Department, FM 17-100, The Armored Division (Washington, D.C.: Government Printing Office, 15 January 1944), p. 68.

Exploitation meant loosing the tanks into the enemy's rear through a hole created by our infantry divisions in his line. The targets in the enemy's rear were his communications and logistical system which were composed of people, trucks, supply dumps, and buildings of varying hardness from tents to bunkers. Clearly, the best weapons against these targets were machine guns supplemented by a weapon with a high explosive (HE) capability. But, recognizing that enemy tanks might appear occasionally, the Army also saw that tank guns should have some ability to defeat those tanks. Clearly, the tank's main gun should be a dual purpose weapon with emphasis on its high explosive capability, which included the ability of the tank to carry plenty of ammunition, at the expense of its ability to perforate armor plate.¹ The Army's doctrine for tanks would have clear impact on how the tank should be designed.

The Army had not arrived easily at its doctrine. There had been a long debate during the interwar years within the industrial nations about the proper use of armor. Various theories had been presented, but it became clear during the first year of the war that the argument had been settled. Germany's doctrine of massed armor had led to the overrunning of Poland in only six weeks. While impressive, the conquest of Poland was completely overshadowed by the cataclysm in Flanders the following spring.

¹Even the dual purpose gun was a result of combat experience in World War II and not a product of prewar development. It should be remembered that machine guns were considered the main weapon of tanks during the interwar period. As evidenced by the 40-mm gun on the British Matilda which fired only solid shot and the 37-mm gun on the German Mark III with its extremely limited high explosive (HE) capability, guns were mainly intended to cope with enemy tanks.

In barely a month's time, German armor crushed the most respected army of prewar Europe. The immediate problem for Germany's remaining and potential enemies became how to stop the awesome Panzer divisions.

Shocked from complacency, US Army leaders began sifting the accounts of what had happened in France. With limited information, they tried to discover the true nature of the beast and devise some way of coping with it. Brig. Gen. Henry L. Twaddle, whose job as the War Department's G-3 made him responsible for the Army's training and organization, underlined the gravity of the situation by saying, "Stopping enemy tanks and other mechanized vehicles is the biggest job confronting our Army today."¹

Lacking a successful European model, the US Army devised its own, unique system for antitank warfare--tank destroyers. The American concept, which committed most of its antitank assets to semi-independent battalions which were assigned to a central force pool, was not duplicated in any other army. Essentially, other armies merely increased their antitank firepower through bigger, better, and more numerous antitank guns. The antitank formations of other nations reinforced or were organic to divisions. Divisions continued to fight the antitank battle. In contrast, the United States developed a definite doctrine to counter tanks and created special units to implement the doctrine. American doctrine visualized fighting tanks behind the divisions with specialized units under corps or army control.

¹"Notes on G-3, Anti-tank Conference, 14-20 July 1941, War College, Washington, D.C." (hereafter cited as AT Conf.), Andrew D. Bruce Papers (hereafter cited as Bruce), Archives, US Army Military History Research Collection, p. 7.

Like the tank destroyer battalions, American gun motor carriages, which were popularly called tank destroyers or TD's, were unique to the US Army. Designed to fit a specific doctrine, the fast, turreted, lightly armored tank destroyers of the United States had no foreign counterparts. The European armies reacted to the need to provide mobility and armor protection for increasingly heavy antitank guns in other ways. The British specialized in mounting antitank guns on trucks; the Germans favored the modification of existing, often obsolete, tank chassis to carry the largest gun possible. Russian efforts mimicked the Germans. The visible differences between the tank destroyers and the German or Russian self-propelled guns reflected opposing tactical views. And the wartime development of America's specialized vehicles proved to be more difficult than the German or Russian ventures which were straightforward adaptations that sacrificed gun traverse for bigger guns. Developing the desired gun motor carriages proved to be the biggest obstacle involved in creating the tank destroyers. Development of new equipment took time; meanwhile, the tank destroyers had to enter battle with makeshift equipment, hastily built during the first years of the Army's expansion.

The test of combat affected both doctrine and equipment. The limitations of the first tank destroyers forced the adoption of equipment unsuited to tank destroyer doctrine--towed antitank guns. This started a new path of development, and doctrine had to be bent to accommodate the new weapon.

In addition, the tank destroyers rarely faced the enemy that they were designed to meet (massive armored attacks). The big

German tank formations were severely eroded in Russia. Meanwhile, the Germans began piling heavier armor on their tanks. Technical intelligence failed to expose the danger of this new threat although the tank destroyers were forced to adopt far heavier weapons than those envisaged in 1941 in order to combat the heavy German armor.

Perhaps just as important to the fate of the tank destroyers was the fact that their basic doctrine was never fully accepted throughout the US Army. Many officers were simply unaware of the doctrine. Promulgating a radical new doctrine throughout a large army is very time consuming, probably more so than developing equipment. This was particularly difficult in a rapidly expanding army which was hard pressed to teach basic tactics to thousands of officers only recently involved in civilian pursuits. Even more important, many influential officers disagreed with the doctrine. The decision from the top to create tank destroyers had not convinced many important generals that it was the right thing to do, and the Chief of Staff, General George C. Marshall, could not force those generals to use the doctrine in combat. The best method for stopping enemy tanks was debatable before Marshall's decision and remained so afterwards.

There were essentially two conflicting positions. One held that the best defense against tanks was to improve the effectiveness of specialized antitank measures. Tank destroyers were the chosen method of doing this. The opposing idea was that enemy tanks should be stopped by friendly armored formations.

In July 1940 Major General George A. Lynch, Chief of Infantry, advised the G-3 of the War Department to adopt the latter proposition. General Lynch argued that antitank guns, due to

their vulnerability while moving, could only be used to oppose the initial attack of armored forces and were useless if the enemy force achieved a breakthrough. He concluded that "The best antitank defense lies in the defeat of hostile armored forces by our own armored units." According to Lynch, the French had failed because they lacked effective mobile units, and "...anti-tank guns proved inadequate to meet a breakthrough, even against the most lightly armored tanks."¹

General Lynch's proposal was rebutted by none other than General Lesley J. McNair, then Chief of Staff of the General Headquarters (GHQ) and one of the most influential men in the US Army. Born in Minnesota in 1883, McNair had attended the United States Military Academy, graduating in 1904. He had become one of the youngest generals in the Army during World War I after General John J. Pershing had selected him to head the AEF's artillery training. McNair had been responsible for testing the Army's new triangular division in the 1930's, and Marshall's selection of him as Commandant of the Command and General Staff School was a further recognition of his intellectual reputation. His job in the GHQ would ultimately evolve into command of AGF and the responsibility of organizing and training the largest land army ever created by the United States.

McNair was an intellectual of firm convictions. A mathematician, he was never far from his slide rule. His reputation for aloofness was undeserved according to his friends. It

¹Memo from Maj. Gen. George A. Lynch to Asst. Chief of Staff, G-3, dtd. 3 July 1940, RG 337 (Q, AGF), file no. 470.8 to 680.3, National Archives.

stemmed largely from his deafness, a common artillery affliction. And McNair avoided the Pentagon. He refused office space there for AGF, which remained at the War College. His firmness of conviction is perhaps best illustrated by his ruthless efforts to trim excess men and equipment from Army organizations despite bitter opposition from overseas. He made his own inspection trip to Tunisia in 1943 and remained unawed by combat commanders, commenting that "[t]heir offhand and fragmentary views are not infallible."¹

General McNair's response to the Chief of Infantry's memo clearly explained his ideas concerning antitank defense. "It is believed," commented McNair, "that the European war to date has supplied no conclusive lessons as to antitank defense, other than that it has been inadequate." General McNair pointed out that during tests of the triangular division in 1937, antitank units proved to have mobility equal to armor units. He contended that:

Antitank guns must be organized and "multiplied" so as to permit their timely concentration in numbers commensurate with the strength of the hostile tank attack. Their organic assignment to divisions and similar units tends to prevent their concentration when and where needed, and subjects us to the inevitable consequences of dispersion. An antitank gun is cheaper than a tank. Providing antitank guns in fully

¹There is no adequate biography of McNair. Sources are: Chief Warrent Officer E.J. Kahn, McNair: Educator of an Army (Washington, D.C.: The Infantry Journal, 1945), p. 50 (this is more eulogy than biography); Forrest C. Pogue, George C. Marshall: Ordeal and Hope (New York: Viking Press, 1965, pp. 82 and 256; Blance D. Coll, Jean E. Keith and Herbert H. Rosenthal, The Corps of Engineers: Troops and Equipment (Washington, D.C.: OCMH, 1965), pp. 273 (source of the quotation) and 337; and Lt. Gen. (Ret.) Jacob L. Devers, interview at Washington, D.C., 21 March 1974 (hereafter cited as Devers). Coll comments on McNair's aloofness, but Devers disputes this.

adequate numbers is a waste of resources only in case such guns are dispersed so widely as to be effective nowhere..../Antitank/ guns should be organized in tactically self-sufficient battalions, each complete with warning communications...this number of guns should constitute a mobile GHQ¹ reserve, available for meeting major masses of tanks.

General McNair's comments outlined the concepts which ultimately led to tank destroyers. He fought the dispersion of antitank guns, although he was willing to accept some scattering of those weapons. He noted that, "...guns should be provided organically in the infantry division, in order that it never may feel helpless against tanks."²

General McNair opposed tank-versus-tank combat because such action wasted tanks. He pointed out that, "the tank's natural and proper victim is unprotected personnel and materiel." To General McNair, a tank-versus-tank battle would be "...one in which both sides are certain to sustain heavy losses in costly materiel--which could be employed more profitably and effectively against more vulnerable targets."³

The ideas of mass and mobility were essential to General McNair's ideas for antitank warfare. He maintained, "...the great mass of antitank and mobile antiaircraft guns should be held in large masses. This mass should shift along the front

¹Letter from McNair to The Adjutant General, dtd. 29 July 1940, 2d Ind. to Memo from Lynch to G-3, RG 337 (HQ, AGF), file no. 470.8 to 680.3, National Archives.

²Ibid.

³Ibid.

directly opposite the mass of enemy mechanization."¹ By orienting on the enemy's tank forces, General McNair believed that this mass could always be superior to the enemy force in any particular locale.

That General McNair did not advocate any specific organization or weapons is significant. He believed that such details should be determined by field tests. By stating only general concepts, McNair was never maneuvered into defending a doctrine that had not been fully developed. He retained his flexibility and avoided interfering with details or organizations or weapons, although he might disagree on specific issues.

General McNair's influence was apparent in a message that Marshall sent to the War Department G-3 on 14 May 1941:

I am certain that one of our urgent needs is for development, organization and immediate action on the subject of defense against armored forces to include an offensive₂ weapon and organization to combat these forces.

He went on to comment that such a force should use rapid movement to intercept enemy forces and fight them with active defensive tactics. While General Marshall normally would have delegated the creation of such a force to one of the combat arms, he felt that the complexity of combined arms within such units would put them beyond the scope of any single arm. Therefore, General

¹Letter from McNair to Lt. Col. Earl W. Benson, dtd. 20 June 1940, RG 337 (HQ, AGF), file no. 470.8 to 680.3, National Archives.

²Memo from Chief of Staff to Asst. Chief of Staff, G-3, dtd. 14 May 1941, quoted in its entirety in "History of the Tank Destroyer Center," RG 337, National Archives, pp. 6-7. This study is in four parts which cover four periods: 1 December 1941 to 15 November 1943, 16 November 1943 to 28 February 1944, 1 March 1944 to 31 October 1944, and 1 November 1944 to 8 May 1945. Hereafter it will be cited, respectively, as TDC Hist. I, TDC Hist. II, TDC Hist. III, and TDC Hist. IV.

Marshall directed the G-3 to take action on the matter and flatly stated that he did not want to bring up the question of a new combat arm. Thus, General Marshall decided in favor of McNair's views. A new organization which would ultimately be christened tank destroyer, not our own armored division, would form the main defense against enemy tanks.

General Marshall's important decision was based on limited information. Detailed military information reached the United States slowly. It was usually fragmentary and often erroneous. Both Lynch's and McNair's comments reflected these problems (above, pages 12-13). General Lynch's statement about the inadequacy of antitank guns was not supported by the facts--French 25-mm and 47-mm antitank guns could penetrate German light tanks--though he apparently did not know this. McNair's remark about the lack of "conclusive lessons" was an admission of incomplete knowledge. The persistent myth that the Germans had used 70-ton "breakthrough" tanks was a striking example of misinformation. In fact, the Germans possessed no such tanks in 1940. But this falsity was still current when Marshall made his decision.¹ Marshall probably realized that available information was incomplete, but he could not wait for muddy waters to clear. Other theaters, where tanks were unimportant, demanded his attention, and the undeniable fact was that German tanks had played a major role in the French debacle of 1940. German armor was too dangerous

¹Capt. C.R. Kutz claims that heavy tanks made the German penetration at Sedan in "Break-Through Tanks" in Army Ordnance, November-December, 1940, p. 242 and Major A.C. Wedemeyer still considered them a threat in his article "Antitank Defense," The Field Artillery Journal, XXXI (May, 1941), p. 260.

to ignore, and there was no time to wait for slowly accumulating facts to be studied exhaustively. Thus, Marshall asked his G-3 for an antidote to massed tanks but could not offer much time for its development. Many commanders were to disagree with the Marshall solution, and there would be no time to educate them. Combat experience would be inconclusive. Fate decreed that the US Army would not face massed tanks until the Battle of the Bulge in 1944. By then the Germans would have developed heavy, duelling tanks by an evolutionary process which was simpler than perfecting two arms--tanks and tank destroyers--separately.

The development of American tank destroyers continued concurrently with that of tanks, and the two development efforts affected each other. Ultimately, tank destroyers became quite similar to tanks. As the differences between these two weapons decreased, the tank destroyer finally came to be viewed as a less efficient, hybrid tank. The type was abandoned after World War II, when tanks were finally deemed the best antitank weapon. But it took the combined lessons of technological development and combat experience to bring the US Army to the latter viewpoint. During the war, tank destroyers were part and parcel of the controversy over tank development.

CHAPTER II
ARMY ANTITANK DOCTRINE AND ARMY ORGANIZATION
FOR RESEARCH AND DEVELOPMENT

When General Marshall decided to create an offensive organization to combat tanks, he had only a general concept. So the formation of the tank destroyer units would involve not only an entirely new organization, but doctrine and equipment as well, all created from scratch. As the development continued it would have to take into account the on-going lessons of combat which was even then taking place. What is more, the lessons had to be absorbed as best they could be perceived from the limited information available to a neutral nation.

In the same memorandum which directed the creation of the new tactical formation, Marshall also directed the formation of a new staff element in the War Department. He ordered Twaddle to:

...organize in your division a small planning and exploring organization, composed of visionary officers, with nothing else to do but think out improvements in methods of warfare, study developments abroad and tackle such unsolved problems as measures against armored force action....¹

The G-3 established the Planning Branch the following day. A

¹Memo from Chief of Staff to Asst. Chief of Staff, G-3, dtd. 14 May 1941, quoted in its entirety in TDC Hist. I, Chap. I, pp. 6-7.

relatively unknown Lieutenant Colonel of Infantry, Andrew D. Bruce, was named to head the new organization. His most important duty was to explore ideas for the organization and doctrine of the new antitank units.

During the summer of 1941, two events occurred that encouraged American endeavors toward antitank defense. First, the Germans destroyed over 200 British tanks in a single battle in North Africa. This was the first engagement that Americans knew of in which a large number of tanks had been decisively stopped. The first defeat of a large force of tanks was good news in the United States even though the prospective foe had been the victor. In addition, the maneuvers of the Second Army in Tennessee had demonstrated that the location of large enemy tank units would be known continually, permitting friendly antitank units to be moved and massed to counter them.¹

Soon after the Second Army maneuvers, the War Department G-3 assembled an important antitank conference. The prestigious assembly at the Army War College included representatives of the War Department and GHQ; antitank officers from armies, corps, divisions, and service schools; and the Chiefs of Engineers, Artillery, and Infantry. The significance of the conference was twofold. First, it showed that the most influential figures in the Army's bureaucratic hierarchy had lined up to support the Chief of Staff's position. The participants were able to agree on the concept of a mobile, semi-independent tank-killing force. The only serious note of disagreement at the conference was the

¹TDC Hist. I, Chap. I, p. 8. This source does not identify the battle which must have been General Sir Archibald Wavell's attack of 15 June 1941.

statement from Maj. Gen. Courtney Hodges, Chief of Infantry, that the infantry should not be left unprotected against tanks.¹ Arrival at this bureaucratic consensus on the controversial topic of antitank warfare was a milestone. Second, the Conference revealed that the operational concepts and general organization of the new antitank organization had already been developed.

But the consensus was misleading. It meant only that the Army's hierarchy would not oppose the creation of such a force. Success for the new units would depend on the willingness of major commanders to use the new formations properly in combat. With the exception of Hodges, the only dissenting voice, the men at the conference were not those who would go on to command large units against the Germans.

The outline of the tank destroyer force was already well defined at the time of the conference. General Twaddle, the G-3, emphasized that the broad aspects of the problem of building a tank destroyer force could be divided into two phases: first, determining how to use equipment that was readily available and how to organize it properly; and second, developing weapons, organizations, and tactics to stay ahead of any foreign developments. The proposed antitank unit that was explained at the conference included a headquarters battery, a reconnaissance battery, and three antitank batteries.² Perhaps the most substantial change in the subsequent organization was the use of the term "company" instead of "battery." The latter was strictly an

¹AT Conf., pp. 45-46.

²AT Conf., pp. 7 and 76-77.

artillery term and probably seemed too parochial.

General McNair, who made the closing remarks at the conference, emphasized the aggressive nature of the new units:

The counterattack long has been termed the soul of defense. Decisive action against a tank attack calls for a counterattack in the same general manner as against the older forms of attack. A counterattack of course may be delivered by other tanks, but the procedure is costly. There is no reason why antitank guns, supported by infantry, cannot attack tanks just as infantry, supported by artillery, has attacked infantry in the past. Certainly it is poor economy to use a \$35,000 medium tank to destroy another tank when the job can be done by a gun costing a fraction as much. Thus the friendly armored force is freed to attack a more proper target, the opposing force as a whole in much the same manner as seacoast defenses free the Navy for defensive action at sea.¹

Following the July conference, Army planners made rapid progress with the tank destroyer concept. General McNair ordered the Second and Third Armies to form provisional battalions for use in maneuvers. He ordered the Third Army to form groups of three battalions, each under a single group headquarters in an effort to centralize antitank operations even further. The GHQ and men working on the new antitank doctrine viewed the employment of the new units as a success during the maneuver in the fall of 1941 although there was a tendency to disperse the units too quickly and thus dissipate their strength.²

In view of the success of the provisional antitank elements, General Twaddle developed long-range plans for such units. The G-3 recommended four antitank battalions per division for the

¹AT Conf., p. 82.

²TDC Hist. I, Chap. I, p. 14.

fifty-five divisions he envisaged. Of those 220 battalions, 55 were to be organic to the divisions; 55 were allocated to armies or corps; and the remaining 110 were reserved for the GHQ.¹ The large number of antitank battalions (220) recommended is an indication of the seriousness with which the War Department viewed the armored threat.

General Twaddle also recommended that the three established arms--infantry, cavalry, and field artillery--that had an interest in antitank warfare should each be given the responsibility to form antitank battalions for their own units. Furthermore, Twaddle proposed that the Armored Force, which had earlier indicated that it had no desire to accept responsibility for antitank units, should establish an antitank center.² This would have hopelessly confused the effort to create the new units. Each branch would have devised its own tactics and organization, generating a demand for different equipment, and the Armored Force, fully committed to its own pursuits, would have had to umpire the resulting disputes.

Marshall's response was a victory for General McNair and his desire to centralize antitank units. The established branches would assume no responsibility for the new units. The War Department would control the antitank center. No battalions would be allocated to divisions. So all of the fifty-five battalions ordered for immediate activation were to be under the control of the GHQ.³

¹TDC Hist. I, Chap. I, p. 15.

²Ibid.

³Ibid.

The establishment of an antitank center was not intended to create a new arm. Instead, the center was to be similar to the machinegun centers established during World War I, offering a central place for training units with a new type of weapon and new tactics, since such expertise was lacking in the Army as a whole. The units trained by the center would then be allotted to existing organizations.¹

On 27 November 1941, the War Department ordered the activation of the Tank Destroyer Tactical and Firing Center. This day, if any, can be called the official birthday of tank destroyers. Colonel Bruce was named to command the new center which was to be located at Fort Meade, Maryland, until a permanent site could be selected.²

The directive of 27 November also gave a new name to antitank units. The term "tank destroyer" had been used on various occasions for months, but "antitank" had remained the official term. Effective on 3 December, the War Department ordered all antitank battalions to be redesignated "Tank Destroyer" battalions. The old term smacked too much of passive, defensive tactics.³

¹Letter from Bruce to Brig. Gen. Earnest J. Dawley, dtd. 13 June 1944, Bruce.

²Lt. Col. Emory A. Dunham, Tank Destroyer History, Study No. 29 (Historical Section--Army Ground Forces, 1946), p. 6 (hereafter cited as Dunham, Study No. 29). After March 1942 the Center received the title Command. However, Dunham does not clarify the distinction between Command and Center; both terms were used.

³Dunham, Study No. 29, pp. 6-7.

The new Tank Destroyer Center consisted of a Headquarters, a Tactical and Firing Center, a School, and a Tank Destroyer Board. The Center was charged with developing doctrine, cooperating in the development of equipment and organizing and operating the Firing Center, School, and Board.¹ Like the rest of the Army, the Tank Destroyer Center entered a period of rapid expansion.

One of the Army's problems during this period was technical intelligence, i.e., knowing the characteristics of enemy equipment. The Army had received very little information during the first months of the war. However, the British began freely sharing technical information in the fall of 1940, after they were convinced that the United States would almost certainly become an ally. The Russians proved to be equally willing collaborators as far as German equipment was concerned although they remained very secretive about their own designs.² Despite Allied cooperation, technical intelligence remained a problem throughout the war.

With very few exceptions, such as the British discovery of the "V" weapons through aerial photography, technical intelligence depended upon capturing German equipment which could be examined by the intelligence teams that the Ordnance Department provided to the units in combat zones. If the captured equipment was important enough, it was shipped to the United States for further examination.³ Thus, Germany's technical progress was only revealed

¹Dunham, Study No. 29, pp. 6-7. The purpose of the Board was to perform service tests of Tank Destroyer equipment. Every combat arm had its own Board; e.g., Infantry Board.

²Green, Planning, pp. 259-274.

³Green, Planning, pp. 262-263.

after she had managed to put new weapons into production. Equally important, collecting data was only part of the problem of any type of military intelligence. Information had to be evaluated properly before it became useful intelligence. The Ordnance Department's inefficiency in evaluating the characteristics of German tanks would lead to major problems later in the war. But, of course, in the rush to expand the American Army during 1941 no one could wait for improvements in technical intelligence. Army leaders had to organize units and develop equipment based upon what the British, and later Russians, saw in Europe.

The creation of a new arm during wartime was an extremely demanding job. To Andrew Bruce's credit, he managed to juggle all of the varied tasks successfully. He had joined the infantry in 1916, just after graduating from the Agricultural and Mechanical College of Texas. He served in a machine gun battalion of the 2d Infantry Division during World War I and earned the Distinguished Service Cross, the nation's second highest award for valor. After the war, he served in various infantry assignments and attended the Artillery School, the Command and General Staff School, and both the Army's and Navy's war colleges.¹ When Marshall asked for "visionary officers" in 1941, four years of experience on the General Staff, including headship of its planning branch, had placed the forty-seven-year-old Missourian, who possessed a keen intellect and broad military education, in

¹Letter from Bruce to Brig. Gen. Ernest J. Dawly dtd. 13 June 1944; Letter from Bruce to Lt. Col. Thos. T. Stevenson, dtd. 27 April 1942, both in Bruce, and "Bruce, Andrew Davis, Lt. Gen. (05257)" Generals of the Army, June 1953, pp. 6-8.

the right place at the right time. He was a natural candidate to head the Tank Destroyer Center.

While at Camp Hood, Bruce had to work under the scrutiny of McNair. General McNair maintained a close interest in what was largely his brainchild. He wrote Bruce on 10 July 1942 that "I personally will give my time without stint if there is anything I can do, since the TD command is very, very high in my scale of priorities."¹ Underlining his interest, McNair saw to it that his son, Douglas, was assigned to Bruce's command. That McNair had a personal relationship with Bruce is evident from one of his letters in 1943; while bemoaning that Douglas, a Lieutenant Colonel of Infantry, would leave the Tank Destroyers to accompany Bruce to the 77th Infantry Division, McNair asked Bruce to "Please make a good chief of staff out of him, for he is certainly not one at this moment."² McNair's interest in the tank destroyers was undoubtedly both helpful and at the same time trying to Bruce. While he could expect support, he could also expect every mistake to be noted.

By the end of December 1941, Colonel Bruce had managed to assemble a skeleton staff at Fort Meade. He and his staff selected a permanent site during January 1942 at Kileen, Texas, but the Center did not officially move there until 14 February. Even after the Center had moved, it had to stage its operations from Temple, Texas, since there were no facilities at the Kileen site, which had been christened Camp Hood. Some of the civilians who owned property on the site had to be forcibly removed. The

¹Letter from McNair to Bruce, dtd. 10 July 1942, Bruce.

²Letter from McNair to Bruce, dtd. 11 June 1943, Bruce.

first tank destroyer battalions, which arrived at Camp Hood in March and April of 1942, had to move into field sites on the reservation and use materials from old CCC camps for construction. The completion of a limited number of buildings finally permitted the Headquarters of the Tank Destroyer Center to move into Camp Hood on 20 August 1942. In spite of its problems, the Tank Destroyer Center managed to train forty-two battalions by 13 April 1943.¹

One of the most significant accomplishments of the Tank Destroyer Center during this formative period was the completion of Field Manual 18-5, Organization and Tactics of Tank Destroyer Units which was published in June 1942.² This manual provided the doctrine for all tank destroyer units. It was the clearest presentation of American antitank concepts before US involvement in combat. Even after the war, the men who had developed the doctrine explicated in 18-5 steadfastly supported it. As representatives of the Tank Destroyer Center commented after the war:

Although this manual has since been revised, tank destroyer officers most closely associated with the development of tank destroyer doctrine and tactics, some of whom have observed tank destroyer units in action overseas, believe that the basic doctrine set forth in this first edition of Field Manual 18-5 was, and is, correct.³

The organization outlined by FM 18-5 was, in effect, a combined arms team organized as a battalion of 842 men. The combination of arms extended down to the level of the platoon.

¹Dunham, Study No. 29, pp. 10-11.

²Ibid.

³Ibid.

Each platoon had four sections. The base of the platoon consisted of two gun sections, each with two guns. A security section, mounted in two armored cars, protected the flanks of the platoon and, as an additional duty, performed reconnaissance. An anti-aircraft section of two vehicles protected the gun sections from enemy aircraft, which reportedly accompanied every German tank attack. The platoon leader rode in his own armored car, and the platoon also had an extra vehicle for ammunition.¹

The tank destroyer company was composed of three tank destroyer platoons with a total of twelve guns. Two of the platoons were heavy, while one was light. The only difference between the light and heavy platoons was the fact that the gun sections of the light platoon had light antitank guns (37-mm) while the heavy platoon had 3-inch or 75-mm guns. The company, totaling 170 men, also possessed elements for various services including motor maintenance.²

The battalion's headquarters company supported the battalion staff and provided the normal battalion services, such as transportation. Three similarly organized tank destroyer companies formed the basis of the battalion. However, the battalion also controlled one additional element, a reconnaissance company, whose size was unusual for a battalion.³

The reconnaissance company, organized with three platoons,

¹U.S. War Department, Organization and Tactics of Tank Destroyer Units, FM 18-5, dtd. 16 June 1942, pp. 32-48, hereafter cited as FM 18-5, 42.

²FM 18-5, 42, pp. 48-55.

³FM 18-5, 42, pp. 56-67.

was intended to scout ahead of the battalion to find routes and firing positions and to protect the tank destroyer companies from surprise. Each reconnaissance platoon had two sections, each with an armored car and several light vehicles. In addition, the reconnaissance company had a pioneer platoon whose primary function was to aid the movement of the battalion by construction work and removing obstacles; it could also lay minefields.¹ The tank destroyer battalion thus was a combination of artillery (antitank guns), mobile infantry (security sections), and mechanized cavalry, not to mention the antiaircraft and engineer elements.

In addition to the organization of battalions, FM 18-5 also explained the organization of group headquarters for tank destroyers. This was strictly a tactical headquarters of about company size. Its main assets were communications and a group staff. Intended to control several battalions (usually three), the group headquarters was designed for temporary assignment to major maneuver units, such as corps, to organize tank destroyer forces against a major tank threat.²

Aggressiveness was the watchword of tank destroyer tactics. As FM 18-5 described their role, "Tank destroyer units are especially designed for offensive action against hostile armored forces." However, "offensive" as used in tank destroyer tactics must be qualified; the term actually meant a mobile defense. It did not mean, as it did in tank or infantry units, to close with

¹FM 18-5, 42, pp. 65-67.

²FM 18-5, 42, pp. 113-122.

the enemy. For tank destroyers, "...offensive action consists of vigorous reconnaissance to locate hostile tanks and movement to advantageous positions from which to attack the enemy by fire." The important distinction between attacking and attacking by fire was apparently not understood by some commanders.¹

Another integral aspect of tank destroyer doctrine was the tank warning net. This was a communications network, primarily radio, dedicated to the task of warning friendly units about the presence of enemy tanks. It was not a responsibility of the tank destroyers. The major maneuver units such as corps or divisions were expected to establish such nets, and available tank destroyers would react to the information.²

A scenario might best explain the operation of a tank destroyer battalion as prescribed in official doctrine. The battalion would receive word through the warning net of an enemy tank attack. Operating from a position in the rear, the battalion would dispatch its reconnaissance company to gain contact with the enemy force and inform the battalion of enemy dispositions and locations. The battalion commander would then move his tank destroyer companies to positions where they could bring the enemy under fire. The battalion would destroy the enemy armor or delay the enemy until enough tank destroyers could be assembled to annihilate him. With prior warning, a tank destroyer group or groups in sufficient strength to counter the enemy armor would have been assembled before the attack.

¹FM 18-5, 42, pp. 7 and 19.

²FM 18-5, 42, pp. 127-182.

One important aspect of tank destroyer doctrine was to prove unacceptable to most division commanders. The tank destroyers were not to be used to defend the frontlines. As FM 18-5 stated, "Organic antitank weapons of front line units are used for this first line of defense; tank destroyer units form the mobile reserve."¹ This assumed penetration of friendly frontlines, particularly since most of the Army's antitank assets had been concentrated in tank destroyer units.² All this was based on the lessons of the European War as perceived in the United States. A massed tank attack could always penetrate a frontline. It was impossible to give the entire front enough antitank weapons to stop such a highly concentrated attack. So, tank destroyers must not be frittered away in linear defense but should remain in reserve so they could concentrate to stop the breakthrough.

As a corollary of concentration, tank destroyers were more oriented to the enemy force than to terrain. This was a most peculiar aspect of tank destroyer doctrine. Most ground combat units of battalion size spelled out their objectives in terms of terrain. Tank destroyers, however, used terrain as a means and not as a goal.

¹FM 18-5, 42, p. 7.

²This statement needs qualification. American industry was rich enough to give the US Army the best of both worlds. Infantry divisions contained sixty organic antitank guns, more than the French divisions of 1940 which had only fifty at full establishment. But the planners of 1941 thought hundreds of guns were needed to stop a Panzer attack so the statement is correct. See Maj. Robert A. Doughty, "French Antitank Doctrine," Military Review, LVI, May 1976, pp. 36-48 for details on French organization; and Kent Roberts Greenfield, Robert R. Palmer, and Bill I. Wiley The Organization of Ground Combat Troops (Washington, D.C.: Historical Division, Department of the Army, 1947), pp. 301-302 for American organization.

One idea not specifically mentioned in FM 18-5 was McNair's concept of pooling assets. If a specific type of unit was not needed continuously by a division, it should not be made an organic part of the division. Such units, if assigned, were wasted when not in use. General McNair believed, therefore, that special units should be pooled and attached to divisions as needed. This enabled the Army to reduce the total number of such units and employ those available more economically. McNair used the concept of force pooling throughout the organization of the Army, applying it to antiaircraft and separate tank battalions as well as to tank destroyers.¹

This doctrine made it vital for tank destroyers to have mobility superior to tanks. Tank destroyers had to be able to move fast enough to intercept the enemy force, while avoiding close combat with the tanks or their supporting infantry. The tank destroyers also needed to arrive at the battlefield first in order to select firing positions. FM 18-5 stressed the advantage to be gained for tank destroyers by firing while stationary, preferably from covered positions, in order to fire much more accurately than moving tanks.

The need for mobility had persuaded the men of the Tank Destroyer Center to adopt self-propelled rather than towed guns. As FM 18-5 stated, "The primary weapons of tank destroyer units are self-propelled guns...."²

¹See Greenfield, Organization, pp. 290-297, for a discussion of McNair's ideas about pooling forces.

²FM 18-5, 42, p. 8.

There had been a long controversy over the relative merits of self-propelled and towed guns. Even as late as the Antitank Conference of July 1941, the matter had not been settled. Colonel Bruce observed at the conference:

As to the limbered weapon or the self-propelled weapon controversy suffice it to say that we shall have limbered weapons for some time to come, but we shall develop and try out the self-propelled mount.¹

However, by the spring of 1942, Brigadier General Bruce (recently promoted) and his men had definitely decided on self-propelled guns.

But the main supporter of the tank destroyer concept, General McNair, was a firm believer in the towed gun. Early in 1941, when General Marshall had directed that a study be made of the possibility of developing a self-propelled antitank gun, he had remarked:

It occurs to me that possibly the best way to combat mechanized force would be to create antimechanized units on self-propelled mounts, with emphasis on visibility (on the part of the gunner), mobility, heavy armament, and very little armor.²

McNair was quick to disagree with Marshall's point of view.

General McNair had had considerable experience with an experimental self-propelled gun back in 1930 and "...felt no hesitation in condemning it." He believed that the advantages of self-propelled mounts were few and were far outweighed by their disadvantages, as he indicated in the following comparison:

¹AT Conf., p. 28.

²Memo from Col. Orlando Ward, Secretary, General Staff to Asst. Chief of Staff, G-3, dtd. 8 January 1941, RG 337, (HQ, AGF), file no. 470.8 to 680.3, National Archives.

A. Advantages.

1. Speed of entering action and withdrawing from it. The latter is a doubtful advantage, since such guns should stay, not move.
2. Protection of cannoneers by armor.

B. Disadvantages.

1. Vulnerable target due to size.
2. Concealment in action difficult.
3. Unstable firing platform.
4. Probably slower due to weight.
5. Disability of either gun or motor renders both useless.
6. Greater weight (bridges).
7. Probably greater cost and slower production.¹

Despite his strong views, McNair did not interfere with the decision to adopt self-propelled weapons for tank destroyers. However, the controversy was by no means settled in the spring of 1942.

The decision to fix a wartime tank destroyer doctrine before the equipment was designed, let alone produced, was the most uncertain issue of all. The manual admitted that:

It is prepared for the guidance of units that will be equipped with materiel now being developed; units equipped with substitute materiel must interpret and modify the provisions of this manual to fit their particular needs.²

Substitute equipment was to be the rule for tank destroyer units for nearly two more years.

Thus the US Army, during the early years of the Second World War, had moved decisively and perhaps too audaciously to counter the threat of enemy tanks. General McNair's early concepts of a

¹Letter from McNair to Asst. Chief of Staff, G-3, dtd. 16 January 1941, 1st Ind. to memo from Ward to G-3, RG 337 (HQ, AGF), file no. 470.8 to 680.3, National Archives.

²FM 18-5, 42, p. iv.

pool of mobile antitank guns were already hardened, by the fall of 1942, into tactical doctrine and organized units. But military technology could not immediately provide the necessary weapons.

The need for new weapons brought the Tank Destroyer Center into intimate and continuous contact with the Army's organization for research and development. While decisions normally tended to flow downward in the Army's hierarchical organization, weapons development necessarily involved horizontal communication. The users of equipment did not have the facilities or expertise to produce that equipment. This was particularly true of items as complex as tank destroyers and tanks. Further, given the importance of these items to military thinking in World War II, they were not subject to easy compromise. To complicate General Bruce's problems, he found his superior headquarters, AGF, to be an uncertain ally.

Along with the responsibility for the organization, doctrine, and training of all ground combat units in the Army, AGF was also responsible for the characteristics of their equipment. This responsibility reflected the obvious need for equipment that was suited to the doctrine by which the Army was trained and organized to fight. For example, the heavy, lumbering JagdTiger of the German Army was obviously unsuited to tank destroyer doctrine. Although AGF was not directly responsible for developing equipment, it had to approve the product before it could be produced in quantity. Successful performance during the service boards', e.g., Tank Destroyer Board, tests was AGF's main criterion for assent.

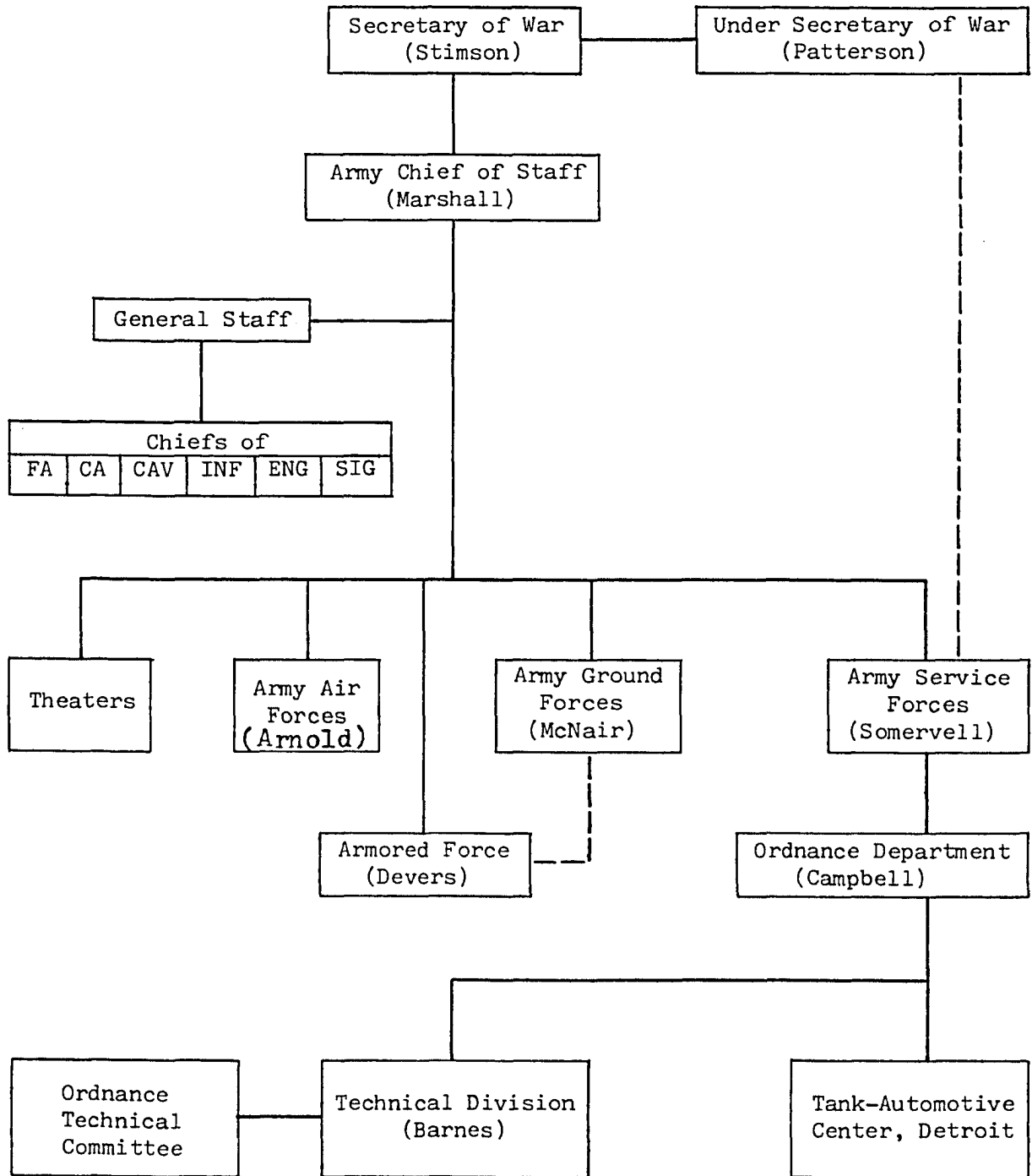
AGF had resulted from the experiences of the Army in World War I and the early months of World War II. The GHQ, modeled on the headquarters of the American Expeditionary Force of the first war, quickly proved inadequate for the numerous theaters of the second.

Marshall had also found himself with over sixty agencies reporting directly to him. Appalled by these complexities and the GHQ's inadequacy to command forces overseas, Marshall persuaded President Franklin D. Roosevelt to issue an executive order reorganizing the Army. The results of that order are simplified in Figure 1. It created three major commands in the United States: Army Ground Forces (AGF), Army Service Forces (ASF, first called Services of Supply, SOS), and an autonomous air command, Army Air Forces (AAF). Forces overseas were the responsibility of theaters such as the European Theater of Operations (ETO).¹ The semi-autonomous status of the Armored Force will be explained later.

While the responsibilities of the GHQ had been reduced by its transformation to AGF, they were still immense. Though the 220 divisions envisaged in 1941 were ultimately reduced to 90, it was still a formidable task to organize and train them. As Chief of Staff of the GHQ, McNair was Marshall's obvious choice to command AGF. Training and organizational problems occupied most of McNair's time, but he still maintained an active interest in the development of equipment.

¹Greenfield, Organization, pp. 4-6, 14; and Pogue, Ordeal, p. 256.

Figure 1



ARMY ORGANIZATION

The element of McNair's headquarters which accomplished day to day coordination with development efforts was the Requirements Section. Chief of the section was always a general officer. The Requirements Section, which reviewed and consolidated equipment needs of organizations controlled by AGF, always reflected McNair's views. AGF steadfastly opposed producing tanks equipped with large antitank guns. If such a gun were needed it belonged on a tank destroyer. Tanks were believed to be an offensive weapon employed through holes in the enemy's lines or against his flanks to envelop his forces and destroy his communications. Heavy tanks were unnecessary since artillery and infantry would open the holes in enemy lines. For the future, McNair and AGF remained open-minded. Referring to proposed modifications to an experimental heavy tank in 1943, McNair commented that:

Development should not wait for the requirement to arise but should anticipate and provide for needs in advance....Although there appears to be little requirement for heavy tanks at the present time there is no assurance that they will not be needed in the future. It is therefore believed that every effort should be made to increase the efficiency of this weapon without delay.¹

Despite McNair's willingness to accept tank development, he could and did vigorously oppose production when he believed that unneeded or inferior equipment would end up in the hands of the troops. So the immediate attitude of AGF toward developmental tanks and tank destroyers was crucial. There was little point in developing a vehicle for which no production orders would be forthcoming. Since the agency responsible for developing both those vehicles, the

¹Letter from CG, AGF to Chief of Armored Force, dtd. 2 March 1943, file no. 470.8, Records of the Army Ground Forces, RG 337, National Archives. / Hereafter these files will be cited as AGF followed by the file no., e.g., AGF (470.8).⁷

Ordnance Department, was forced to depend upon AGF concurrence for their production, any differences of opinion over roles and characteristics tended to lead to disputes.

The principal antagonist confronting General Bruce and AGF was the Ordnance Department of General Gladeon M. Barnes, Chief of the Technical Division (later renamed Research and Development Service). Similar to McNair in many ways, Barnes was as sure of his judgments and as passionate a bureaucratic infighter. In 1910, he had joined the Army as a twenty-three-year-old lieutenant of Coast Artillery. He soon transferred to the Ordnance Department and spent World War I designing heavy artillery. His postwar assignments gave him experience in both production and design, and he ultimately owned some thirty-four patents. Most of his experience involved various types of artillery, but he also worked with tank development. Attendance at both the Industrial War College and Army War College further broadened his education. He returned to the Office of the Chief of Ordnance in July 1942, after a two year stint in Industrial Services helping to organize production, and took charge of the newly formed Technical Division.¹

Maj. Gen. Levin H. Campbell, Chief of Ordnance, formed the Technical Division from his technical staff after he became convinced that a separate organization was necessary in view of the large number of development projects (over 1000 during World War II). Barnes manned the division with both Ordnance officers and civilian scientists, many of whom had donned uniforms as

¹Biographical Data on Brig. Gen. Gladeon M. Barnes, dtd. 1946, OHF.; and Green, Planning, pp. 220-223.

Reserve officers after Pearl Harbor. He also enlisted the services of many eminent civilian scientists and stayed on good terms with the National Defense Research Council, twice being the liaison officer with that organization which grew into the powerful Office of Scientific Research and Development. He involved civilian scientists in as many research projects as possible with some outstanding exceptions including tank development. Aided by the President of Chrysler Motors, he fended off the efforts of the Research Council to "interfere" with tanks.¹ The OSRD had so much to do elsewhere that the rebuff concerning tanks was probably not a matter of major concern to it. But Barnes would also try to exclude Army agencies from tank development, and this would create problems.

Barnes gained influence in excess of his organizational position by his willingness to go outside of his chain of command to air his views. On one occasion he went directly to Secretary of War Henry L. Stimson to have a piece of equipment sent overseas. He was aided by Stimson's close interest in developmental equipment which had acquainted him with the Secretary.² But jumping channels was not standard procedure for Barnes. He generally worked through Campbell and ultimately through the Ordnance Department's superior headquarters, ASF. While Campbell generally agreed with Barnes on development matters and supported him, Barnes was less successful with ASF.

¹Green, Planning, pp. 223-228, and Irvin Stewart, Organizing Scientific Research for War (Boston: Little, Brown and Company, 1948), p. 153.

²Green, Planning, p. 234.

The reorganization of the Army in 1942 had reduced the influence of the Ordnance Department by introducing ASF between the Chief of Ordnance and the General Staff. Despite AGF influence, ASF was the source of production and development orders. Placing AGF and ASF in proper perspective, AGF had no direct control over the development or production of tanks or tank destroyers, it only established the requirement.¹ ASF exercised the requisite control. However, ASF consistently refused to order production without AGF concurrence and often sided with AGF on disputed issues. ASF was less involved in the controversies over tank and tank destroyer development because that headquarters generally was not interested in specific characteristics. There was certainly no lack of firm leadership at the top of ASF since Lt. Gen. Brehon B. Somervell was renowned as a "ruthless expediter" and "...capable of running down those who got in his way."² But Somervell never championed the Ordnance Department's philosophies on tank development.

Members of the Ordnance Department had a twofold solution to the Army's program of tank development based on their experience with designing and testing tanks during the interwar years. First, Barnes and the Ordnance Department had become convinced before Pearl Harbor that a heavy tank would be required for modern war. They developed heavy tanks and advocated production of those tanks throughout the war. Second, most of the energy from

¹James E. Hewes, From Root to McNamara: Army Organization and Administration, 1900-1963 (Washington, D.C.: Center of Military History, US Army, 1975), pp. 120-126.

²Pogue, Ordcal, pp. 296-298.

engineers of the Ordnance Department was expended on a program intended to replace the M4. This program, the T20 series of developmental tanks, became the main focus of tank development in the United States. The views of Barnes and other Ordnance officers were represented in the characteristics of those tanks. Ordnance officers bent every effort to force their views and developmental tanks on the combat arms. As Colonel G. MacLeod Ross, Britain's Chief technical liaison officer for tanks observed, "...it was Ordnance which decided what was good for the user in terms of weapons...neither Staff nor user got a sympathetic hearing from Army Ordnance."¹

Lack of such experience with tank destroyers did not prevent the Ordnance Department from pressing its views in that area, even if it meant ignoring the stated desires of the user. Relations between Bruce and the Ordnance Department became increasingly acid as he resisted what the Ordnance Department considered to be good tank destroyers although they seemed to have no consistent view of such a vehicle. In the midst of this bitterness the Ordnance Department found an occasional ally in the Armored Force.

Although the Army had experimented with mechanized forces during the interwar years it had not created a branch, such as Infantry or Cavalry, for tankers. The National Defense Act of 1920 had recognized the experiences of World War I by authorizing some new branches, such as the Chemical Corps and Air Corps, but it forbade the Army to create any further, new branches. Both

¹G. MacLeod Ross, The Business of Tanks, 1933 to 1945 (Elms Court, Great Britain: Arthur H. Stockwell Ltd., 1976), p. 197.

chemical weapons and aircraft were highly technical and had been major factors in the build-up for World War I. Tanks were not as exotic and had not been as important. Marshall shrank from asking the Congress to change the law even after German victories in Europe made it apparent that modern war required tank formations. This would have exposed the Army's internal bickering over the subject at a time when he needed Congressional support for the more important objective of expanding the Army. Therefore, the Armored Force was established with little fanfare on 10 July 1940 as a semi-autonomous organization based on the experimental mechanized unit at Fort Knox, Kentucky. The War Department fended off efforts to give the Armored Force the independent status enjoyed by the Army Air Force.¹

Lack of a branch for tankers during the interwar years was a serious problem for American tank development. Although a cavalryman might have been interested in tanks his survival in the army depended on a visible loyalty to horses. While he might have been assigned to a mechanized unit promotion depended upon spending a significant part of his time in horse cavalry. An infantryman was similarly limited from becoming too involved with tanks. The result was that the only men with continuous experience with tanks during the 1920's and 1930's were in the Ordnance Department. This experience buttressed the Ordnance Department's view that the men in the newly created Armored Force were amateurs

¹Hewes, From Root to McNamara, pp. 65-66. Hewes tells us that Maj. Gen. John K. Herr, Chief of Cavalry in 1938, went to his deathbed claiming that "the Army had betrayed the horse."

as far as tanks were concerned. AGF and the Armored Force encountered this attitude throughout the war, and their views were also less convincing because they did not present a united front.

The relationship of Fort Knox to the GHQ and McNair remained unclear. Although McNair supervised their training, he executed a personal, not official influence and generally left the Armored Force to its own devices.¹ The relation of the Armored Force to GHQ is clarified by understanding the command relationship of the Armored Force Commander, Maj. Gen. Jacob L. Devers, and General Marshall.

Although an artilleryman, Devers had followed armor developments during the 1930's. He was busy organizing a division and building a post at Camp Bragg, North Carolina in 1941, when he received a telephone call from General Marshall. Marshall ordered Devers to inspect Fort Knox and then report directly to him. Devers found the Armored Force in some disarray. A good organization lacked leadership because the commander, Brig. Gen. Adna Chaffee, was mortally ill. General Devers returned to Camp Bragg after reporting this to Marshall. Soon after arriving home, Devers received another phone call from Marshall ordering him to take command of the Armored Force. Marshall told Devers to by-pass the GHQ and report directly to him. Thus, GHQ had little effective control over the Armored Force although GHQ was responsible for the latter's training. Devers' relations with the GHQ were smoothed by the fact that he and McNair were close personal

¹Greenfield, Organization, pp. 408-410.

friends, and he consulted with McNair whenever he was taking some action that affected the GHQ.¹

While Devers commanded the Armored Force, the Ordnance Department generally coordinated tank development with Fort Knox. After the creation of ASF in 1942, Devers noted that, "McNair was out of the picture." A big, ebullient man, Devers believed in fast action coordinated by telephone, avoiding the red tape of "...all those damn letters." The relations between the Armored Force and the Ordnance Department were generally smooth although they did not always agree.²

The Armored Force suffered a sharp drop in status after Devers departed in May 1943 to take command of the European Theater of Operations (ETO). The new Commander, Maj. Gen. Alvan C. Gillem, did not enjoy direct access to the Chief of Staff. McNair moved speedily to bring the Force under the control of AGF and renamed it the Armored Command. Although the Armored Command retained its equipment testing organization, the Armored Command Board, it was reduced to the same status as other Commands under AGF, e.g., Tank Destroyer and Antiaircraft. The demise of the Armored Force's independent voice in tank development became complete in February 1944 when the AGF Requirements Section took control of the Armored Board, and Armored Command was reduced to a training headquarters, Armored Training Center.³

¹Devers.

²Ibid.

³Greenfield, Organization, pp. 408-410.

During the period that it was still independent, the Armored Force agreed and disagreed with both AGF and Ordnance. Like AGF, it believed a heavy tank was not required and that tanks should avoid duels with other tanks. However, the Armored Force believed that tanks might occasionally be forced to fight enemy tanks:

Attacking tanks frequently encounter hostile tank units unexpectedly. At other times they may be required to attack hostile tanks deliberately in order to break up an attack or a counterattack.¹

This suggests that the Armored Force was clearly more concerned than AGF about the antitank capabilities of their tanks.

Despite the subsequent disappearance of the Armored Force, another agent was sporadically important to tank development. The G-4 Section of the General Staff monitored tank development closely. Although rarely a party to disputes, the G-4 acted as the final arbiter. Through the G-4, General Marshall influenced development. Marshall judged that his chief contribution to arming the troops was through direct intervention.² Although he did not take the initiative in development details, Marshall was always interested in the subject. Finally, Marshall's intermittent participation in disputes over development was always decisive.

The official organ for coordination between those interested in development was the Ordnance Technical Committee (OTC). All service branches sent representatives to committee meetings where

¹FM 17-33, Armored Force Manual, The Armored Battalion, Light and Medium (Wash., D.C.: Government Printing Office, 18 September 1942), p. 37

²Forrest C. Pogue, George C. Marshall: Organizer of Victory (New York: The Viking Press, 1973), pp. 136-138.

they had the opportunity to review any experimental item of equipment before it was standardized. The approved Ordnance Technical Committee Minutes (OTC) justified all development and production actions. Since the OTC proved to be more of an institution to formalize decisions already made, its records reveal little of the controversy behind those decisions. The most important arguments were usually settled before OTC meetings, which were clearly dominated by the Ordnance Department. Barnes always chaired the meetings while the branches were typically represented by Lieutenant Colonels.¹

At this point it might clarify the Army's research and development organization to trace the path of a hypothetical piece of equipment through the organization. A subordinate Command of AGF, e.g., the Tank Destroyer Center or the Armored Command, would decide that a new armored vehicle was required. This would be reviewed by AGF. Following AGF's approval, the specifications went to the OTC. There the Engineers might tell the committee that no bridge would hold the proposed vehicle or the Signal Corps might point out that it lacked a radio. After the OTC settled such detailed problems, it approved the new vehicle. AGF would then ask ASF to develop the new item. Of course, the G-4 of the War Department supervised all of this on behalf of General Marshall. ASF in its turn ordered the Ordnance Department to develop the new item. During development there might be several repetitions of this cycle to deal with modifications. If the vehicle were a success, the OTC recommended that the G-4 standardize it. Then

¹Maj. Gen. Gladeon M. Barnes, "Research and Development Service," Journal of Applied Physics, December, 1945, p. 749. Barnes implies that the OTC members exercised veto power over developments but reviewing samples of the minutes of those meetings does not support this.

AGF could request ASF to produce the vehicle in large quantities, and ASF would order the Ordnance Department to do so. In summary, the user, e.g., the Tank Destroyer Center, asked for a weapon with certain characteristics and then the Ordnance Department would design and develop it. So much for theory.

Insofar as tanks and tank destroyers were concerned the fairly straight-forward process rarely occurred. The Ordnance Department was inclined to design and develop equipment without referring to the users. So two types of equipment were developed during World War II: what the user wanted and what the Ordnance Department wanted. In the case of tank destroyers the Army would receive both types. In the case of tanks--neither.

Conspicuously absent from the development process were the combat forces overseas. Theater commanders had no institutional method to influence equipment development except by appealing directly to the War Department. The Ordnance Department received most of its operational information from Ordnance officers in the field with combat units.¹ Through personal letters to Barnes, and others in the Ordnance Department, these men expressed their views about needed combat equipment. Similarly, combat officers wrote to friends in the Armored Force or AGF. Numerous overseas trips by observers from Ordnance, AGF, and the Armored Force were another major source of information. The resulting views were necessarily based on limited observation and interviews that became increasingly obsolescent as the interval after the trip lengthened. Combat units were infrequently queried and, until

¹Green, Planning, p. 239.

things went wrong, seldom offered advice to help developers. A lack of regular comments from field commanders to United States equipment developers was a weakness in the Army's wartime development procedures, but the judgments of the men in the combat zones would prove to be little better than those of men in the United States.

When the commanders overseas did respond, their comments were often of little use. Men facing an enemy have more immediate problems than theorizing about equipment needed in the distant future. Their thoughts were confined to present needs and problems. They were too busy to absorb the experiences of other units or intelligence about the enemy. Their comments, by the time they reached the United States, concerned the last battle--not the next.

Contributing to the lack of information flowing back to the United States was the fact that the combat forces did not have much experience with armored combat. American experience in opposing large German armored formations was very limited until late in the war. This relates directly to the main criticism of both tanks and tank destroyers, their ability to compete with the Germans in this type of fighting.

Of course the United States Army had to begin building tanks with no combat experience. During 1940 and 1941, as war became increasingly likely, the Army began to expand tank production. During this period designers had to depend on British advice or the limited information available from other European sources such as Frenchmen who had escaped the Germans.

CHAPTER III

DEVELOPING TANKS AND TANK DESTROYERS: 1942

When the events in Europe during 1940 revealed the importance of tanks, the United States found itself with virtually no tanks and, more important, no factory that could build them in large quantities. The first thing was to create production facilities. Such factories as the Detroit Tank Arsenal were the result. With production the major problem, there was little time to refine tank designs. The United States would build what it had.¹

The fall of France found America with the M2 medium tank. Lack of funds during the interwar years had forced the Ordnance Department to spend its time developing components instead of tanks. These components were brought together during 1938 and 1939 to produce the M2, a mobile machine gun nest (six machineguns and a 37-mm gun), which reflected prewar thinking and the fact that tanks were still controlled by the Chief of Infantry. The Germans' use of 75-mm guns on tanks had convinced both the Ordnance Department and the Infantry that something would have to be done with the M2. The advantages of mounting a 75-mm gun in a turret were obvious but threatened to take too much time. In the interim, designers managed to mount a 75-mm gun in the sponson² of a more

¹See Thompson, Procurement, Chaps. X and XI for a discussion of production problems.

²The sponson is that part of a tank's body (hull) which extends over the tracks.

thickly armored M2. This tank was the M3, Grant (or Lee in its British configuration), that entered combat at Gazala in 1942. Before the M3's had appeared in the desert their replacement had already entered production.¹

The M4, Sherman, was a further refinement of the M2 and M3. The most important improvement was a turret mounting the 75-mm gun of the later M3's. During 1942 the most important task for the Ordnance Department, Armored Force, and AGF was to produce enough of these fine vehicles which compared favorably to the Russians' vaunted T-34. Production problems were solved; over 40,000 M4's were built during the war. They fought from the deserts of North Africa to the jungles of New Guinea and proved to be a reliable, effective weapon. They were the most important tank in the American and British Armies, and Russia received nearly 7,000 of them. Despite the criticisms levelled against this tank, many participants of the war defended the Sherman tank. Perhaps General Jacob Devers, who commanded the 6th Army Group during the last months of the War in Europe, provided the best assessment: "It did the job."²

Of course the M4 was not the only tank developed in the United States during World War II. Before the Sherman entered production the Armored Force was already pressing to replace it. During 1941 and 1942, the Armored Force bent most of its development efforts toward the M7 medium tank, apparently intended to

¹There are several adequate sources for development and production of the M4. The ones used were Green, Planning, passim and Chamberlain, Tanks, pp. 105-115.

²Devers.

match the Germans' Mark III. Beginning development as the T7 light tank in February 1941, the M7 was seized upon by the Armored Force as the replacement for the M4. General Devers told Somervell in January 1942 that he was in favor of only one tank, a 20-ton tank with the 75-mm gun. The T7 would fill the need. Devers believed that the T7 should be altered to take the 75-mm gun and termed it "the tank of the future."¹ By modifying the T7, Devers expected to combine the firepower and armor of a medium tank with the speed and maneuverability of a light tank. By August 1942, before Armored Force tests, the tank was standardized and orders for 3000 of them placed with the International Harvester Company.² During November, Devers went so far as to say that Sherman production should be cut if that was necessary to expedite production of the M7.³ But when the M7 finally reached Fort Knox for tests in January 1943 Armored officers found that a promising light tank had grown into a mediocre medium tank. The M7 exceeded its specified weight and was inferior to the Sherman in nearly every respect.⁴ Further development promised only to match, not surpass, the M4. On 16 March, General Devers manfully

¹"History of the Armored Force, Command and Center," AGF Study No. 27, Historical Section, AGF, 1943, p. 86 (hereafter cited as Study No. 27). The date, January 1942, is questionable. "Chronology," History of the Light Tank T7 Series (This document is like the T20 Hist. and will be cited the same way.), OHF, shows no mention of Devers asking for the 75-mm gun until 15 June 1942.

²Chamberlain, Tanks, pp. 97-98.

³Letter from Devers to CG, AGF, dtd. 5 November 1942. G-4 (470.8).

⁴The specified weight of the M7 was twenty-five tons, but the first pilot tanks were found to be four tons overweight. This was a surprise. International Harvester began an investigation to find out if overweight castings and forgings were the culprits. M7 Chron., 10 February 1943.



Figure 2. Sherman tanks in Italy, 1944. Source: US Army Photo.
(All photographs so referenced are from the Still Photograph Library
US Army Audio-visual Activity, the Pentagon.)



Figure 3. The T7 tank (still armed with the 57-mm gun). Source:
M7 Hist.

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asked AGF to have M7 production terminated as fast as possible.¹ Meanwhile, International Harvester had built a plant and hired labor to produce the tanks. Despite the commitment, ASF terminated the contract in the last days of March, even as the first M7's rolled off the production lines. After this \$16,000,000 mistake, McNair agreed with Maj. Gen. Richard C. Moore, Chief of the Requirements Section, who commented on 3 March: "This is a mess."² The attitude around AGF Headquarters toward Ordnance was reflected by the remark:

The Ordnance Department is not entirely blameless in this matter. They have been too prone since the War started to recommend standardization and procurement without adequate field tests.³

The fate of the M7 reveals not only the growing acrimony between the users and the Ordnance Department but also something about the users' concepts of tank development.

The Armored Force's conception of the M7 showed a lack of vision. The M7 was a technological dead end. Even if it had met its specifications, the M7 would hardly have been better than the Sherman. In essence, the M7 was a slightly faster and lighter Sherman with a lower silhouette. But it had the same gun and thinner armor than the M4. It would have solved none of the problems that later caused so much criticism of the Sherman, and it would probably have been harder to modify with larger guns or heavier armor. If the M7 could have magically appeared in

¹Letter from Devers to CG, AGF, dtd. 16 March 1942, G-4 (470.8).

²Memo, HQ, AGF from Requirements to CG, dtd. 11 March 1943, G-4 (470.8).

³Ibid. OCM item 18582, dtd. 6 August 1942, in M7 Hist., includes the following specifications: Weight - 25 tons; Height - 7 ft 10 in; Speed - 35 mph.

steel in 1942 when Devers demanded it, it would have been more than a match for the most numerous German tank of the day, the Mark III. But the M7 could not have been produced in numbers sufficient for combat before late 1943. By then the Germans had already moved on to heavier and better armed tanks such as the Panther and Mark VI.

This is not to say that German designers were blessed with far more vision than their American counterparts. Germans were rudely shocked during the summer of 1941 by the Russian T-34. German sources agree that the T-34 shocked their conservative development program into the effort that produced the Panthers and Tigers.¹ The Mark III, conservatively armed with a short-barreled 50-mm gun when a longer, higher velocity weapon was available, was rendered suddenly obsolete by the T-34. Need for the Mark IV's ability to carry the long 75-mm gun capable of killing T-34's was the reason that Germany phased out the Mark III, not a better crystal ball.

The superiority of German tanks in 1944 was due more to experiences on the Eastern front than to German wisdom. During 1941 and 1942 the Germans and Russians were already embarked on a gun-armor race, while US designers were dependent on British experience. The inadequacies of German and Russian material were quickly revealed by large, frequent tank battles. Appropriate modifications were immediately demanded by the troops. Both

¹Dr. F. M. von Senger und Etterlin, trans. by J. Lucas, German Tanks of World War II (New York: Galahad Books, 1967), pp. 59-62 and Heinz Guderian, Panzer Leader (New York: Ballantine Books, 1957), pp. 215-222.

contries fought their battles relatively close to their technological bases, not separated by 3000 miles of ocean.¹ Even after America entered the war, her forces did not experience the frequency or scope of armored warfare that was commonplace in the Russo-German War. But this lack of experience could not be permitted to stop development efforts in America.

Before the first Sherman tank appeared on the battlefield, the Ordnance Department began designing its replacement. Observations of tank operations in North Africa guided ordnance officers. Such people as Colonel Colby, who returned from a trip to the Middle East in April 1942, outlined the characteristics of the new vehicle.² Formal approval for a prototype of the new tank, termed the M4X, came from the Services of Supply (the later ASF) on 24 May 1942.³ Ordnance engineers completed a wooden mockup the same month.⁴ The M4X evolved into a number of related prototypes generally termed the T20 series.

Convinced that a low silhouette was vital, ordnance engineers sought to reduce the size of the M4X through a design technique called space engineering.⁵ Since most of a tank's weight is

¹New tanks could arrive speedily at the front or existing ones returned to the factory for modification. The ready availability of factory technicians and spare parts helped the troops to cope with the technical problems inherent in new vehicles.

²Hunnicut, Pershing, p. 49.

³T20 Chron., 24 May 1942.

⁴Hunnicut, Pershing, p. 49.

⁵Hunnicut, Pershing, p. 50.

represented by the armored surfaces of the hull, reducing the size also meant that thicker armor could be used without increasing the weight of the tank. However, since the hull must be large enough to contain the tank's crew, weapons, engine, and fuel, there are limits as to how much the size of the hull can be reduced. Concepts of space engineering hold that a given volume can be most efficiently contained with minimum surface area by a cubical shape. Thus, space engineering led Ordnance engineers toward a box-shaped hull for the M4X. The box hull eliminated the sponsons of the M4. Box hulls were a feature of the entire T20 series and every American tank for three decades afterwards.

Representatives of the Armored Force were conspicuously absent from the initial meetings concerning the design of the T20. One might have expected Ordnance officers to solicit the views of the Army's principal tank agency, but this was not the case. For its part, the Armored Force seemed willing to allow the Ordnance Department to pursue an independent development program, probably because the M7 still seemed to be the most promising new tank. Although General Devers was allowed to view the mock-up of the T20 in May 1942, this hardly constituted active participation from the Armored Force.¹ The T20 series remained a mystery to the rest of the Armored Force until 18 August when a formal conference at Fort Knox introduced the new design to the tankers.² With little chance to influence the basic design of the T20, the Armored Force was obliged to accept the tank as conceived by Ordnance engineers.

¹Hunnicut, Pershing, p. 50.

²T20 Chron., 18 August 1942.

Participation of the Armored Force in the development of the T20 continued to be grudgingly accepted by the Ordnance officers rather than actively solicited, despite the failure of the M7. The last fact explained much of the subsequent lack of enthusiasm of the officers of the Armored Force for the new tank. They were convinced that the Ordnance officers' box hull sacrificed too much crewspace and ammunition to gain a low silhouette.¹ The conference mainly succeeded in establishing agreement that three interchangeable turrets would be constructed: a 76-mm gun version, an auto-loading 75-mm gun version, and a 3" gun version.

Besides the interchangeable turrets, Ordnance engineers decided to experiment with various transmission systems. Honoring a suggestion from General Devers on 18 September, they also agreed to install a torsion bar suspension system in one prototype.² In October 1942 the Ordnance Technical Committee agreed to development of three versions of the T20: T20, T22, and T23. (The versions of the T20 series are summarized in Table 1.)³ In addition, the designers decided to drop the 3-inch gun turret since the 76-mm gun proved to be successful.

¹Telephone interview with Maj. Gen. (Ret.) Louis T. Heath, member of the Armored Board 1941-1945, on 15 September 1974 (hereafter cited as Heath).

²T20 Chron., 18 September 1942.

³Item 20342, Ordnance Committee Minutes (hereafter cited as OCM), dtd. 24 April 1943, RG 156, National Archives. Item 20342 mentions item 19000 of 8 October 1942, which established the three different tanks. See Hunnicutt, Pershing, pg. 50 ff. for a full account of all the various versions of the T20 series.

TABLE 1
SELECTED MODELS OF THE T20 SERIES

The table below should clarify the T20 series for the reader. The basic tanks (no E suffix) all had a common hull and the 76-mm gun except for the T25 and T26 (both 90-mm guns). The logic of the E suffixes is as follows: no suffix--basic tank, E1--75-mm autoloading gun, E2--3-inch gun (none constructed), and E3--torsion bar suspension. The tanks listed below reached at least prototype stage.

T20	76-mm gun and torquematic transmission ¹
T20E3	T20 with torsion bar suspension ²
T22	76-mm gun and Sherman transmission
T22E1	T22 with 75-mm autoloading gun
T23	76-mm gun and electric drive
T23E3	T23 with torsion bar suspension
T25	T23 with 90-mm gun
T25E1	T25 with torquematic transmission
T26	T23 with 90-mm and heavier armor
T26E1	T26 with torquematic transmission
T26E3	T26E1 modified as a result of testing and standardized as the M26
T26E4	T26E3 with high velocity, T15 90-mm gun
T26E5	T26E3 with heavier armor

¹Torquematic was a name for a hydro-mechanical transmission that substituted a torque converter for a mechanical clutch. The term will be used throughout this study. This is basically the same "automatic" transmission that is present in many modern automobiles.

²Torsion bars are bars that twist to provide springing action as opposed to the compression action of coil springs. They are used in many modern tanks and some automobiles; e.g., the Volkswagen "Beetle."

Work on the design continued smoothly during the last months of 1942. Complaining about difficulties in securing materials, Colonel Colby wrote to Services of Supply on 16 September 1942, asking for a higher priority than AA3 for the T20 series.¹ Only two weeks later the Army-Navy Munitions Board granted the highest priority, AA1, to the T20.² During the remainder of 1942 Ordnance engineers worked to complete prototypes while the Armored Force continued to be preoccupied with the M7.

Although the Armored Force could develop new weapons while the M4 provided a satisfactory solution for current needs, the situation of the Tank Destroyer was not nearly as happy. Tank Destroyers were a new concept with no background of interwar design and engineering. Indeed, no one was sure exactly what a tank destroyer should be. And the Tank Destroyer Center would not have the luxury of peacetime maneuvers and extended study to find out.

As General Twaddle mentioned at the Antitank Conference in July 1941, the problem of equipping tank destroyer units involved two phases: first, making use of what was immediately available; and, second, developing weapons to go beyond any foreign developments. Bruce agreed with General Twaddle and emphasized that the two problems should be handled simultaneously rather than successively (See page 20).

Even though Bruce knew that development would take years, he

¹T20 Chron., 16 September 1942.

²T20 Chron., 1 October 1942.

described the characteristics of the "ideal tank destroyer":

What we are after is a fast-moving vehicle armed with a weapon with a powerful punch which can be easily and quickly fired and in the last analysis we would like to get armored protection against small arms fire so that this weapon cannot be put out by a machine gun.¹

But his comment that the "super-duper" tank destroyer would have its gun "pointing to the front or in a turret" illustrated that the vehicle was still only an idea. He expanded his ideas with a naval analogy by saying:

The tank destroyer that we have in mind is in reality similar to the battle cruiser. Its tactics in operating against the tank (the battleship) have to be different from the tactics we would employ in operating the tank (the battleship) against the tank (the battleship). Speed, visibility, and hitting power of the tank destroyer should compensate to some degree /for/ its lack of armor. The tank destroyer must be cheaper in time and material for production than the tank.²

Colonel Bruce (and later the officers of the Tank Destroyer Center) realized that the ideal tank destroyer would take years to develop, but the characteristics mentioned by Colonel Bruce in the summer of 1941 were very important to this evolution. Doctrine was written for the ideal tank destroyer; Bruce's characteristics thus guided development efforts of the Tank Destroyer Center. Just as important, proposed or interim weapons were measured against the same characteristics.

During the antitank conference, Bruce mentioned those weapons that were immediately available in reasonable quantities. Most important were the 37-mm gun, then the standard antitank gun,

¹AT Conf., pp. 29 and 32.

²AT Conf., p. 28.

and the 75-mm gun, which was to be replaced as the standard field artillery piece. The major problem with both weapons was finding means to make them self-propelled. Colonel Bruce also mentioned efforts being made to mount the 3-inch antiaircraft gun on limbered and self-propelled carriages but noted that none of those weapons would be available before the spring of 1942.¹ In its early days the Tank Destroyer Board struggled to bring different versions of the three weapons to completion.

When the Board was established on 1 December 1941, there were eight types of 37-mm gun carriages, two types of 75-mm gun carriages, and three types of 3-inch gun carriages under test or nearing completion.² Winnowing out the best of the various carriages was the Board's first major task.

The most complete carriage was the one for the 75-mm gun, the T12. A prototype of this vehicle had been completed in time for inspection by the conferees at the Antitank Conference. It was merely a 75-mm gun mounted on a half-track, a combination finally standardized as the M3.

Inspiration for the M3 had come from a French designer who mentioned to Colonel Bruce that the French Army had successfully mounted 75-mm guns on the back of trucks. The idea interested Bruce and other members of the Planning Branch, who saw the Army's new half-track personnel carrier at Aberdeen a few days later. Soon after that, General Twaddle and Ordnance officers agreed to try out the mount.³

¹AT Conf., p. 28.

²TDC Hist. I, Chap. VI, pp. 3-4.

³TDC Hist. I, Chap VI, p. 3; and AT Conf., pp. 28-29.

Despite its hasty beginning, the M3 was successful. By 1 December eighty-six had been completed, and fifty of these were immediately sent to the Philippines. The remainder equipped the first provisional tank destroyer unit. However, Colonel Bruce had made it very clear at the Antitank Conference that the weapon was an expedient.¹ But it made good use of the 75-mm guns available and offered suitable equipment for training. As things turned out, the M3 was still standard equipment for tank destroyer battalions in early 1943.

The M3 did not have all of the desired characteristics for a tank destroyer. Its thin sides and gunshield offered protection against small arms fire only, but not even then if armor piercing ammunition was used. More mobile than tanks only on roads, the M3 was disappointing when operated cross-country. Its best feature was its gun. The venerable 75-mm gun proved to be adequate against virtually all the enemy tanks that it faced in 1942. And there were good supplies of major types of ammunition, e.g., high explosive, armor piercing, and smoke. The gun's main weakness was its relatively low velocity (2,000 fps.); its resulting curved trajectory made range estimation critical, a particularly difficult task against moving targets. Still, the M3 was the best gun motor carriage available during 1942.

Efforts to provide a carriage for the 37-mm gun were less successful. Most of the proposed carriages were small trucks that could carry the gun. Light, one-quarter ton trucks could not

¹Dunham, Study No. 29, pp. 2-3; and AT Conf., pp. 28-29.

withstand the firing of the gun, while heavier, armored vehicles required long development periods. The compromise was the Fargo, a shielded 37-mm gun mounted on a pedestal in the back of a Dodge, three-quarter ton truck.¹

The Tank Destroyer Center intended to use the Fargo, designated the M6, only in training.² But the first tank destroyer units to arrive in North Africa still had the vehicles. The wisdom of restricting the Fargo to training would be proven in combat.

By far the most serious defect in the M6 was its lack of armor. The vehicle was vulnerable to all types of fire, and the problem was accentuated by the short range of the 37-mm gun that made a close approach to the enemy imperative. Moreover a four wheel drive truck simply could not match the cross-country mobility of tracked vehicles. Still, the M6 was cheap and, above all, available.

Neither the 37-mm gun or the 75-mm gun were to remain as mainstays of tank destroyer firepower, each giving way to the 3-inch, an obsolete antiaircraft weapon. Originally designed for seacoast defense, the 3-inch gun had been adapted for antiaircraft use. It was employed in that role during the interwar years. By 1940, the 3-inch gun was no longer in production since its replacement, the 90-mm, was already in sight, but production could have been quickly resumed since all the necessary tools and dies were in storage. Like the 75-mm ammunition, 3-inch rounds were

¹TDC Hist. I, Chap. VI, pp. 3-4.

²Dunham, Study No. 29, p. 9.

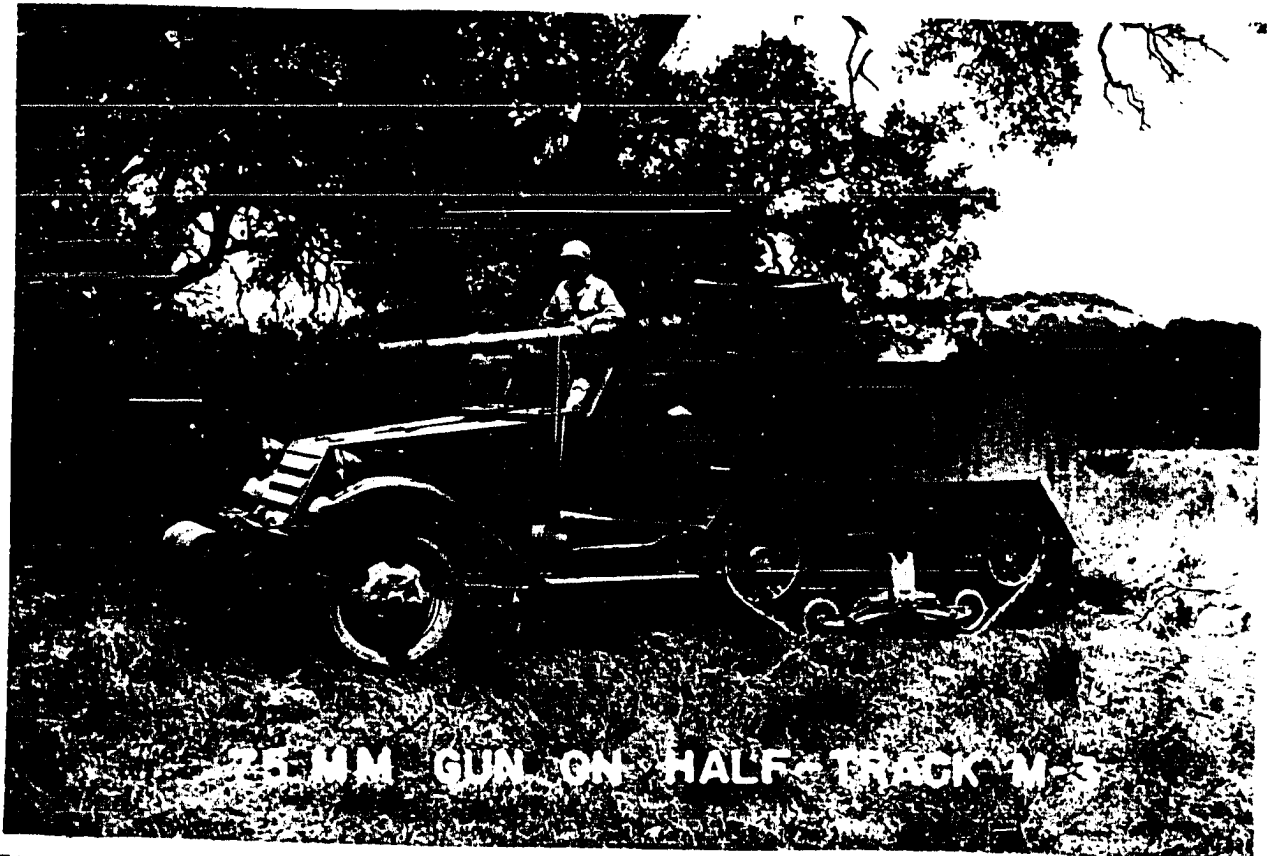


Figure 4. The M3. Source: TDC Hist.

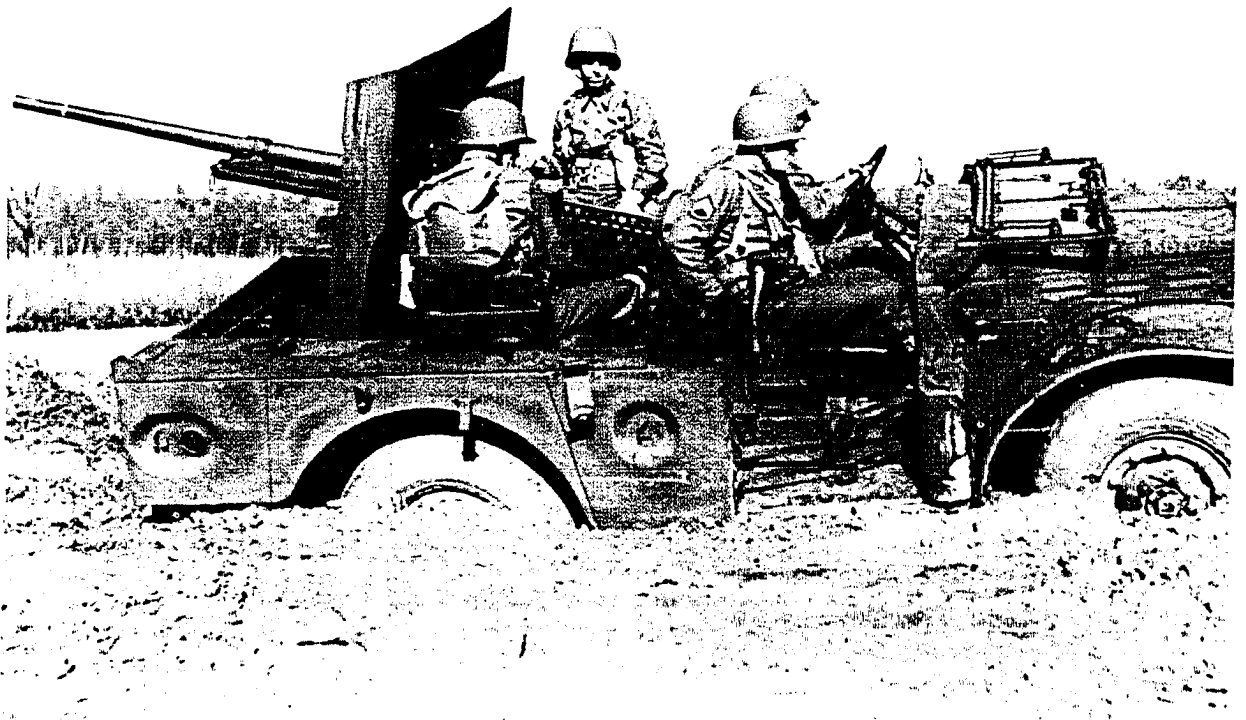


Figure 5. M6 in Arkansas mud, 1942. Source: US Army Photo

already perfected. The high velocity (2,600 fps.) necessary for fire against aircraft made the 3-inch gun a natural choice for use against tanks.¹

Significantly, Colonel Bruce began to favor high-velocity guns more for their flatter trajectory in relation to the 75-mm rather than for their greater penetrative power.² As General McNair had pointed out in 1941, "The prime essentials of an anti-tank gun are unusually clear-cut: first, to hit; second, to penetrate upon hitting."³ During 1942, the 75-mm seemed to have adequate penetrating qualities. For example, Brigadier General Gladeon M. Barnes, head of the Ordnance Department's research and development, reported after a visit to North Africa that, "The 75-mm gun in the M-4 tank has destroyed the best German tanks at ranges as great as 2,500 yards."⁴

While searching for other means to achieve flatter trajectories, the Tank Destroyer Center also considered the 57-mm anti-tank gun, which was being produced in the United States during 1942 for British requirements. (See Appendix II for characteristics of antitank guns.) The 57-mm offered virtually the same

¹TDC Hist. I, Chap. IV, pp. 8-9.

²Letter from Bruce to Brig. Gen. W.B. Palmer, dtd. 26 January 1943, Bruce.

³Letter from GHQ (/s/ McNair) to the Adjutant General, dtd. 6 January 1941, RG 337 (HQ, AGF), file no. 470.8 to 680.3, National Archives.

⁴"Ordnance Annex," dtd. 18 January 1943, to Report of the mission headed by Lieutenant General Jacob L. Devers to examine the problems of Armored Force units in the European Theater of Operations (hereafter cited as Devers Report), RG 337 (HQ, AGF), file no. 320.2/26 (Armd C), National Archives.

penetrative capabilities as the 75-mm but with greater (2,750 fps.) velocity. However, there were reports that the gun's solid shot shattered against the face-hardened armor on German tanks.¹ A further disadvantage was that the English failed to design high-explosive ammunition for the 57-mm.

Lacking an alternative, the 3-inch gun became the focus for increasing the firepower of tank destroyers. The increased penetrative capabilities of the 3-inch gun were a fortuitous adjunct to its flatter trajectory.

With admirable foresight, General Barnes had moved to adapt the 3-inch gun for antitank use in the fall of 1940. On 9 September, Barnes directed the Artillery Division of the Ordnance Department to draw a layout for the gun to be mounted on the carriage of a 105-mm howitzer. General Barnes predicted that, "...this combination might make a very satisfactory antitank gun of great power."²

By 26 December, the Ordnance Technical Committee had approved the development of the 3-inch antitank gun. Sharp disagreement came in the form of a nonconcurrence from the Infantry Board at Fort Benning:

In view...of the lack of information as to the need for a weapon with the great penetrating ability of the subject gun, the Chief of Infantry cannot agree that there is a need for antitank materiel of such great weight and consequential poor mobility.³

¹TDC Hist. I, Chap. IV, p. 10, and memo from McNair to Chief of Staff, US Army (Attn: G-3), dtd. 5 January 1943, AGF (472)..

²Memo from Col. Barnes to Capt. Weyher, dtd. 9 September 1940, History of 3-Inch Gun Carriage M1, M1A1, and M6 (hereafter cited as 3-Inch Hist.), OHF. This document is like the T20 Hist. and will be cited the same way.

³Item 16368, dtd. 27 December 1940, OCM.

Development of the 3-inch gun continued despite opposition from the Infantry. On 22 October 1941, technicians at Aberdeen fired the first prototype. Less than a month later, 12 November 1941, the Ordnance Technical Committee recommended that the gun be standardized.¹ But the Field Artillery Board was far less enthusiastic after it received one of the guns in February 1942.² The most serious deficiencies discovered at Fort Bragg were the difficulty in traversing the weapon on side slopes and the position of handwheels which made the gunners unable to traverse and elevate the gun while keeping their eyes to the sight.³ Serious as these were, they were not to be the main problem with the 3-inch gun.

Army Ground Forces (AGF) requested that production of the 3-inch gun be cancelled on 13 May 1942, and this request was approved by SOS on 21 May.⁴ General Campbell, Chief of Ordnance, strongly protested. Brig. Gen. Lucius D. Clay, Assistant Chief of Staff for materiel at SOS, answered him in a memorandum on 26 July that enumerated the technical deficiencies of the weapon. The clinching argument was that, "...the Tank Destroyer Center, sole users of the 3" Antitank gun, consider it essential that this gun be self-propelled." Clay concluded: "...this Headquarters feels

¹3-Inch Chron., 22 October 1941 and 12 November 1941.

²3-Inch Chron., 28 February 1942.

³Letter from HQ, SOS to Chief of Ordnance, dtd. 26 July 1942, 1st Ind. to Memo from Chief of Ordnance to CG, SOS, dtd. 17 July 1942, 3-Inch Hist.

⁴Memo from Chief of Ordnance to CG, SOS, dtd. 17 July 1942, 3-Inch Hist. mentions a letter from AGF and its indorsement by SOS.

that the decision to cancel the project for a towed 3" Antitank Gun was well considered."¹

But the towed 3-inch gun was soon resurrected, after the failure of a self-propelled version of the gun. The Cletrac, the name being derived from its manufacturer, the Cleveland Tractor Company, had been developed in parallel with the towed 3-inch gun. In 1940, the Cleveland Tractor Company had submitted a design for a self-propelled gun developed from its high-speed tractor that was used to tow military aircraft. The Ordnance Technical Committee approved the idea on 19 December 1940, specifying that the vehicle would mount the 3-inch gun.²

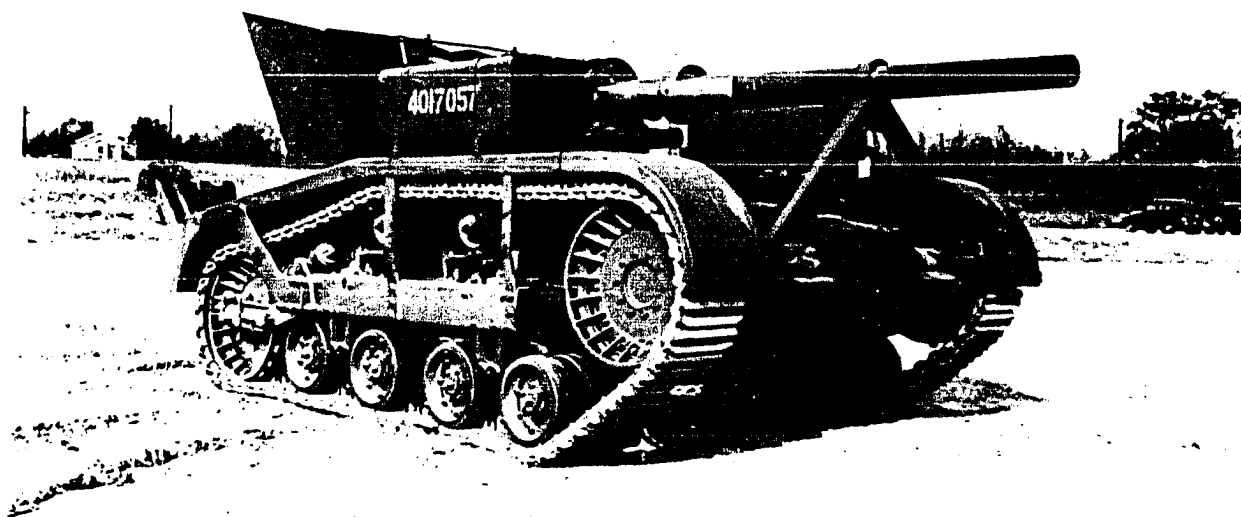
The manufacturer could not deliver a prototype of the carriage, designated T1, until November 1941.³ But numerous problems with the prototype did not stop the Field Artillery Board from recommending its standardization. The Ordnance Technical Committee concurred with the Artillery Board's recommendation on 24 November 1941. Significantly, the newly created Tank Destroyer Center did not comment on the recommendation, probably because the Cletrac was still considered to be an artillery weapon. The War Department approved standardization of the Cletrac as the M5 and directed procurement of 1,580 vehicles on 7 January 1942.⁴

¹Letter from HQ, SOS to Chief of Ordnance, dtd. 26 July 1942, 3-Inch Hist.

²Mrs. Anne B. Jones, 3-Inch Gun Motor Carriages (hereafter cited as Jones, Carriages), unpublished manuscript in OHF, "3-Inch Gun Motor Carriage M5 (T1)," p. 1. (All references to the Cletrac will be from the chapter above.)

³Jones, Carriages, p. 2.

⁴Item 17642, dtd. 24 November 1941 with indorsements, OCM.



M5

Figure 6. The Cletrac. Source: US Army Photo



Figure 7. An M10 in England, April 1944. Source: US Army Photo

Numerous modifications failed to correct its original deficiencies. In addition, its weight grew from the 8 tons originally envisaged to nearly 12 tons. The vehicle's speed fell proportionately. A modified vehicle at Fort Bragg in May 1942 exhibited various faults, including broken tracks and a propensity to set itself on fire.¹

Despite the Cletrac's numerous faults, the Ordnance Department went ahead with measures to put the vehicle into production. Increasingly, the M5 became a vested interest of the Ordnance Department. The completion of a factory to build Cletracs indicated the commitment of ordnance officers to the future of the carriage.² However, none of this effort improved the Cletrac in the eyes of the officers of the Tank Destroyer Center.

The Cletrac was intrinsically bad to Bruce and his men; its mechanical imperfections only made it worse. Protected only by a gunshield, the M5 was vulnerable to all types of fire. This condition was accentuated by carrying ammunition on the fenders and the fact that the gunner and loader rode in front of the shield. And the Cletrac's speed had fallen to 36 mph, no faster than light tanks of the day. Bruce derisively referred to the M5 as the "Cleak track."³

Finally, in July 1942, a vehicle incorporating all of the changes deemed necessary was available at Aberdeen. A crew from the Tank Destroyer Board arrived to test the vehicle. After being

¹Jones, Carriages, pp. 2 and 7.

²Jones, Carriages, p. 8. Jones only mentions the fact that a factory had been constructed.

³Letter from Bruce to Col. Wendell Westover, Asst. Chief of Staff, G-2, Tank Destroyer Center, dtd. 24 November 1943, Bruce.

trained to operate the vehicle, the crew from Camp Hood gave the Cletrac a cross-country test. The results were disastrous. An Ordnance historian commented that "The sides were dished in, the gun supports buckled, the suspensions /were/ out of line, the travel lock folded, and the gun mount loosened." General McNair admitted to Bruce that the M5 looked "pretty hopeless."¹

On 23 August 1942, AGF recommended to SOS that production of the M5 be discontinued because it, "...is not a vehicle of sufficient capacity to handle the 3-inch antitank gun.../and/ ...it is unsatisfactory for Tank Destroyer use."² But the Cletrac's demise only created another problem for McNair's efforts to improve antitank defense.

On 1 July 1942, AGF had decided to replace all 37-mm or 57-mm guns with self-propelled, 3-inch guns.³ The failure of the Cletrac left AGF without the desired substitute. The only available carriage for the 3-inch gun was the M10 gun motor carriage, which weighed some 30 tons. In the same letter that recommended abandonment of the Cletrac, AGF requested that:

...in order to provide an additional antitank weapon of lighter weight than the M-10, it is desired that some of the 3-inch guns previously available for assignment to the M-5 be mounted upon the 105-mm Howitzer carriage (towed).⁴

¹Jones, Carriages, pp. 7-8, and Letter from McNair to Bruce, dtd. 10 July 1942, Bruce.

²Letter from HQ, AGF to CG, SOS, dtd. 23 August 1942, 3-Inch Hist.

³Memo from HQ, AGF to CG, SOS, dtd. 1 July 1942, AGF (472). AGF wanted to keep the 37-mm gun in infantry battalions because it was so portable, but the regimental antitank guns and all tank destroyer units would convert to 3-inch guns.

⁴Letter from HQ, AGF to CG, SOS, dtd. 23 August 1942, 3-Inch Hist.

AGF asked for 500 towed 3-inch guns. So, the failure of the Cletrac rekindled interest in the towed 3-inch gun, though the Tank Destroyer Center did not want the towed weapon. The heavy M10 had already become a bone of contention between General Bruce and the Ordnance Department.

The M10 had been initiated in October 1941 to mount the 3-inch gun in an M3 tank hull with very limited traverse. On 20 March 1942, the Ordnance Technical Committee agreed to develop a turreted carriage based on the M4 tank. The proposed vehicle, the T35, would be an M4 tank with lighter armor and a 3-inch gun mounted in a turret. Fisher Tank Division of General Motors managed to complete two prototypes in April and make the vehicles available for demonstrations at Aberdeen. Various interested parties met on 2 May 1942 at Aberdeen, Maryland to consider production of the T35.¹ Major General Richard C. Moore, Chief of AGF's Requirements Section; General Bruce; and General Barnes were at the meeting. Both Generals Moore and Barnes recommended that the T35 be placed in production, while Bruce disagreed vehemently.² Moore then overruled Bruce and convinced McNair to request production of the T35, which was soon standardized as the M10.³ This was a sign to Bruce that he could not expect support from McNair on every issue.

General Bruce's objections to the M10 were very simple. It

¹Jones, Carriages, "3-Inch Gun Motor Carriages M-10, M-10A1 (T35, T35E1)," pp. 1-2.

²"Notes Taken at Conference at Aberdeen Proving Ground, Md. on May 2, 1942," (hereafter cited as May 42 Conf) Bruce, p. 1.

³"Statement of Colonel G.M. Dean," dtd. 18 October 1945, AGF (470.8).

"...weighs too much and is too slow."¹ The M10 was barely faster than the M4 and was slower than light tanks. Weight also restricted its mobility, limiting the types of bridges that it could cross. "At present," Bruce pointed out, "I am unable to shift a medium tank from several parts of Texas a distance of 20 miles without making a detour of 150 miles to find a bridge that will carry it."² In addition to its weight and speed, the M10 had other disadvantages. Probably the most important technical fault of the M10 was the lack of power traverse. The overall imperfection of the design was exemplified by the necessity to hang counterweights on the rear of the turret to achieve balance.

The conference at Aberdeen on 2 May 1942 exposed an increasingly acrimonious relationship between Bruce and the Ordnance Department. General Bruce fought standardization of the M10 mainly because it was an expedient and partially because it was untested. He feared that accepting the M10 might delay or stop his efforts to get an ideal tank destroyer. As Bruce explained to Moore:

This standardization thing gets my goat. When that is done they might suddenly order 3000 guns on me. They might order those and stop seeking a better weapon.³

General Bruce's misgivings were at least partially prophetic; the Ordnance Department ultimately built over 6,000 M10's. For all its faults the M10 would become, numerically, the most important

¹Letter from Bruce to Brig. Gen. W.B. Palmer, 26 January 1942, op. cit.

²May 42 Conf., p. 6.

³May 42 Conf., p. 4.

tank destroyer in the Army's inventory.

The main objective of the ordnance officers had been to produce enough 3-inch gun carriages to satisfy the requirements handed down by the War Department, with little regard for the quality of those carriages. When General Bruce complained, "We have enough expedient weapons," Colonel John K. Christmas of the Tank-Automotive Command retorted, "We do not have enough expedient weapons to finish up the S.O.S. objective that we were given."¹ Apparently agreeing with the Ordnance Department, Moore cleared the way for production of the M10 despite General Bruce's objections. England's tank expert, Colonel Ross, would agree about the Ordnance Department's motives. He commented that:

...fear of incurring his /President Roosevelt's/ indirect wrath seemed ever at the back of some officer's minds, to the result that they would pass weapons unfit for battle, rather than break the production promise which the Chief of Ordnance had put into the mouth of the President.²

The controversy between Bruce and the Ordnance Department continued until the former finally left the Tank Destroyer Center. During the remainder of 1942, the dispute was especially bitter. General Bruce later wrote of a "terrific battle with Ordnance."³

The Ordnance Department argued that General Bruce did not make his requirements clear and asked for so many changes that development was delayed. Ordnance officers were not without support for their opinions. On 10 December, during a telephone

¹May 42 Conf., p. 13.

²Ross, Business of Tanks, p. 197.

³Letter from Bruce to Westover, dtd. 24 November 1943, Bruce.

conversation with General Bruce, Major General Jacob L. Devers of the Armored Force (who outranked General Bruce) chastised him for not telling the Ordnance Department what the Tank Destroyer Center wanted. General Bruce argued that his desires had remained the same since 1941, but General Devers countered that characteristics were not enough, and General Bruce needed to follow up on development efforts. Bruce clearly did not agree that he was flooding the Ordnance Department with unrealistic changes or failing to coordinate with the developers.¹ However, General Moore supported the Ordnance Department's point of view when he commented to General McNair in reference to one development project, "I do not see how Bruce can ever expect to get any kind of mount for his 3" gun if he keeps asking for changes in design."²

General Bruce remained disgruntled with the Ordnance Department. He was later to remark bitterly, "The biggest obstacle to the creation of Tank Destroyers was found within the Ordnance Department."³

Helping to clear the air, the Palmer Board eliminated several experimental vehicles that might have become matters of controversy. The Palmer Board was the Army's name for the Special Armored Vehicle Board composed of representatives of the

¹"Rough Draft, Conversation between General Bruce and General Devers," undated, Bruce. From other documents the date of this conversation can be established as 10 December 1942.

²Memo from RQT 1 (Moore) to McNair, 22 February 1943, AGF (473.1).

³Letter from Bruce to Westover, undated, Bruce. From other documents the date of this letter can be generally established as November 1943 to January 1944.

Armored Force, Tank Destroyer Center and Ordnance Department which was in session from October to December 1942. The rush to develop fighting vehicles during 1941 and 1942 resulted in a hodge-podge of designs competing to satisfy the same requirements. Every design had supporters, and lucrative contracts were at stake. Barnes easily gained AGF support for a War Department Board which could simplify matters.¹

Headed by Brigadier General William B. Palmer of the Armored Force, the board considered some fifteen armored vehicles in order to recommend those vehicles for service use, development or termination.² Several of the vehicles were of interest to the Tank Destroyer Center.

The Board pared some nine armored cars down to one, the T22 which had been standardized as the M8. The Tank Destroyer Center had been interested in this vehicle since the Center viewed it as a replacement for the Fargo as a light tank destroyer.³ However, the M8 was to be far more important as the standard armored car for American Cavalry units than as equipment for the tank destroyers.

Most important, the Board managed to select a single gun motor carriage. The two eliminated vehicles were a wheeled 3-inch

¹Letter from HQ, AGF to CG, SOS, dtd. 9 October 1942, AGF (470.8).

²Letter from Brig. Gen. W.B. Palmer to the Chief of Staff, U.S. Army, "Subject: Final Report of Special Armored Vehicle Board," dtd. 5 December 1942 (hereafter cited as Palmer Report), AGF (470.8).

³TDC Hist. I, Chap. VI, p. 2.

gun carriage called the "Cook Interceptor" and a 3-inch gun mounted on an M3 light tank chassis.¹ Both would almost certainly have aroused Bruce's ire as further makeshifts. But the survivor, the T49, promised to become the ideal tank destroyer.

That vehicle had originated in February 1942 when Bruce's review of some 200 vehicles under test by the Ordnance Department did not reveal a single vehicle satisfactory for tank destroyer use. This made it necessary to develop the ideal tank destroyer from scratch.

The driving force behind the decision to start afresh was the need for mobility. Volute spring and bogie suspension common to most of the Army's tracked vehicles would not permit enough speed, since vibration became destructive at high speeds.²

General Bruce conferred with an engineer from General Motors, and the two agreed that a Christie suspension was the answer. General Motors designed a track-laying vehicle with a Christie-type suspension. The vehicle was designated the T42 and was intended to mount the 37-mm gun. But the gun was changed to a 57-mm and the designation changed to T49 on 3 April 1942. Since

¹Palmer Report.

²TDC Hist. I, Chap. VI, pp. 15-16. Volute springs are spiraled coils of steel bar which resemble a conch shell and are far more compact than coil springs which can carry the same weight. Bogie wheels are the wheels on which a tank travels. Bogie wheels are generally smaller than the road wheels of torsion bar or Christie suspensions but perform exactly the same function. The difference between the terms is more usage than definition. As a rule, road wheels are independently sprung while bogie wheels are part of a system of levers that couple at least two wheels.



Figure 8. The M1 and M6 towed 3-inch guns. Source: TDC Hist.

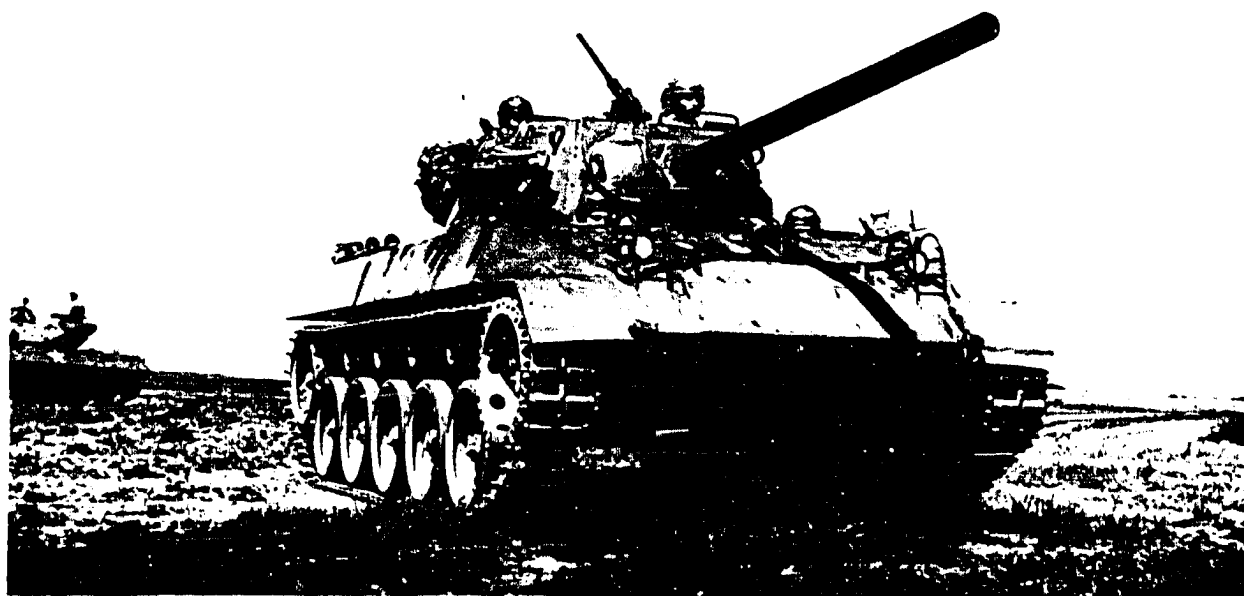


Figure 9. The T70 after standardization as the M18 "Hellcat."
Source: TDC Hist.

the T49 appeared to offer all of the characteristics desired for tank destroyers, Bruce coordinated closely with Buick Motors. He recommended that the armament be changed to a 75-mm gun on 2 July 1942, and this resulted in the designation changing to T67. On 3 September 1942, an example of the vehicle was available at Aberdeen for tests. During the test, General Barnes called Bruce's attention to the new 76-mm gun.¹

This gun was a minor coup for ordnance engineers. They had designed a new gun to fire 3-inch projectiles with the same external ballistics as the 3-inch gun. The new gun was lighter, smaller, and used shorter, space-saving ammunition. Even more beneficial to US tanks and tank destroyers, the 76-mm gun used the same breech block and recoil system as the 75-mm, thus making substitution relatively simple.²

Ordnance officers were enthusiastic about mounting the 76-mm gun in an armored vehicle. After discovering in September 1942 that the gun could be mounted in a M4 tank they recommended, characteristically, that 1000 such tanks be produced.³ But General Devers had too much clout to be forced to accept an unwanted vehicle as had been Bruce's fate with the M10. Until the Armored Force could test these "untried" vehicles Devers would agree only

¹Dunham, Study No. 29, p. 60. The Christie suspension consisted of large road wheels, independently sprung with bell-cranks and coil springs. It was an invention of Walter J. Christie, a controversial figure involved in tank development during the inter-war years, and permitted high speed. The T42's suspension was a Christie type in that it used independently sprung wheels, but it was not a true Christie suspension since it did not use bell-cranks.

²Ibid.

³Memo from Barnes to Campbell, "Subject: History of Tank Guns," dtd. 1 October 1944, OHF.

to building twelve, enough for the tests.¹ General Bruce was more enthusiastic about the new gun.

Shortly after the Palmer Board, Bruce met with representatives of industry and the Ordnance Department in Detroit, and they agreed on characteristics of a T67 armed with the 76-mm gun. The agreement included yet another change, torsion bar suspension which was lighter and simpler than the Christie type. The Ordnance Technical Committee approved the new development project, the T70, on 4 January 1943. Development of the ideal tank destroyer was finally underway after long months of effort and dispute during 1942.²

During its first eighteen months of existence, the Tank Destroyer Center had made great progress towards equipping its unique, new units. The two weapons that were immediately available, the 37-mm and 75-mm guns, had been adapted to self-propelled mounts. Both the M3 and M6 were useful for training, and the M3 would prove surprisingly effective in combat. But the Center's other development projects were slower and more controversial.

During 1942 the Ordnance Department had become increasingly independent of the users. The Ordnance Department clearly had its own views about what equipment was suitable. It would press these views despite the users' resistance. While charging down its own dead-end path in 1942 the Armored Force had been no hindrance. The cooperation of AGF, so evident against Bruce in the

¹Letter from Devers to CG, AGF, dtd. 21 November 1942, AGF (470.8).

²TDC Hist. I, Chap. VI, p. 17.

Cletrac and towed gun programs, would change to implacable resistance when the T20 tanks began appearing in 1943. But the worst controversies were still in the future.

Although there were disagreements about development in 1942 the US Army had made great strides towards equipping its tank and tank destroyer units. The 3-inch gun of the M10 would increase firepower in a short time, and the T70 was well advanced. But the first tank destroyer units would still have to fight with improvised weapons, the M6 and M3. Most important, an increasing number of Sherman tanks would begin reaching British and American troops to prove that vehicle's worth in North Africa.

CHAPTER IV

COMBAT EXPERIENCE IN THE MEDITERRANEAN: 1942-1943

When American troops began fighting Germans in late 1942 they found a North African war different from the one experienced by the British from 1940 through 1942. In the flat expanses of Egypt and Libya tactics had been governed more by logistical difficulties than by terrain. The unobstructed expanses of Cyrenaica had always given the British and Germans an open, southern flank which permitted easy maneuver. In contrast, the campaign in Tunisia involved a continuous front studded with easily defended chains of mountains. Some preconceived doctrinal notions would founder in Tunisia. The place of the light tank in combat was to be among the first of them.

Light tanks had been an important part of prewar armored theory. Fast, light tanks were the hussars of interwar thinking, while medium and heavy tanks were the cuirassiers. For the exploitation role of armor so favored by interwar thinking the light tank was far better than the slower medium tanks. It was faster and its small size and weight made it less restricted by bridges or terrain obstacles. Further, during the interwar years and early years of war the light tank generally carried the same weapons as the heavier tanks. Both American cavalymen and British theorists whom they studied favored light tanks. They expected light tanks to be the cutting edge of armored formations. Medium tanks were to support light tanks when they encountered heavy

resistance and also were the main equipment of the independent tank battalions which supported infantry divisions.

There had been little evidence to dispel trust in light tanks during the first years of the war. Germany had used many light tanks, and the Russians were known to have thousands of them. Britain's Crusaders and Honeys (American M3 light tanks) had had a good deal of success in the desert. But the increased effectiveness of German antitank weapons and restrictive Tunisian terrain would leave faith in light tanks as riddled as the tanks themselves.

During the first weeks of the Tunisian campaign light tanks had experienced a few limited successes because the German front was thinly manned. As German defenses thickened, light tanks became deathtraps. German tanks and guns could destroy American light tanks at ranges which did not permit any effective reply. At the end of the campaign Lt. Gen. Omar Bradley commented that, "Operations in Tunisia have indicated that the use of the light tank M5 in other than reconnaissance missions results in excessive losses." Generals Patton, Eisenhower, and others concurred.¹ Light tanks were relegated to reconnaissance duties for the rest of the war, and their numbers in American formations dropped

¹Letter from Captain Atlee W. Wampler, Jr., to Commanding General, Armored Force, dtd. 15 April 1943 with the following indorsements: (1) CG, II Corps directs CG, 1st Armd Div to comment, 1 May 1943; (2) Comment of CG, 1st Armd Div (Maj. Gen. Ernest H. Harmon), dtd. 2 June 1943; (3) Comment of CG, II Corps (Lt. Gen. Omar N. Bradley), dtd. 15 June 1943; (4) Comment of CG, I Armored Corps (Lt. Gen. George S. Patton, Jr.); (5) Comment of CG (Maj. Gen. C.R. Huebner), Force 141 (US Contingent); and (6) Comment of Commander in Chief, Allied Force Headquarters (Lt. Gen. Dwight D. Eisenhower) signed for the Commander in Chief by Brig. Gen. T.J. Davis, all in AGF (470.8).

drastically. America's medium tanks were far more successful.

The Sherman tank received unstinting praise from both British and Americans as a result of the campaign in North Africa after the former's first use of the tank at El Alamein. The chief complaint about Shermans was that there were not enough of them to go around. Some British and American units were forced to soldier on with the M3 Grant because there were not enough Shermans. The limitations of the M3 and its sponson-mounted gun had been realized when the tank was designed. Combat experience underlined this. The arrival of ever-increasing numbers of Shermans in the combat zones during 1943 solved the most important complaint about the quality of American tanks.

Faith in the Sherman was based on a surprisingly limited amount of experience in tank versus tank combat. There was only one major action between American and German tank formations in North Africa. The Germans had given the American Army an embarrassing lesson in modern warfare at the Kassarine Pass in February 1943. Although Sherman tanks were involved, Army leaders attributed the defeat there, quite accurately, to lack of experience rather than to any fault in the tank.

The Sherman compared well with German tanks. The German Mark III was clearly inferior but was withdrawn from all battlefronts during 1943. The German Mark IV had lately received a high-velocity 75-mm gun, superior to the one on the Sherman, but the latter was better protected. As the war progressed the Germans piled heavier armor on the Mk IV, but on balance--considering firepower, protection, and mobility--the Sherman was superior to the Mk IV. More ominously the Germans introduced the Mk VIE, the

Tiger I. This heavy tank, with its effective 88-mm gun, was later to be proclaimed American tanks' nemesis. But it did poorly in North Africa. The British were able to stop it with small antitank guns and regarded it as a failure.¹ From hindsight the Tiger's ineffectual performance was due to poor tactics, terrain, and scarcity rather than to its quality. But it did not make a big impression in North Africa. Moreover, battles with German tanks during the campaigns in Sicily and Italy later in 1943 did not shake confidence in the Sherman.

The next significant encounter with German tanks after North Africa came at Gela, Sicily, in July 1943. Ninety Mk III's and Mk IV's of the Hermann Goering Division supported by seventeen Tigers attacked the American forces landing there. With available antitank guns, tanks, and naval gunfire, the Americans dealt the Germans a resounding defeat. They left forty-five tanks on the battlefield, ten of them Tigers.² Although naval gunfire and faulty German tactics both played key roles in the German defeat, there had been no convincing demonstration that American equipment was inferior. For example, while a contingent of the 2d Armored Division lost an entire platoon to Tigers, the Americans also found their Shermans capable of dealing with the heavy German tanks. Encountering six Tigers moving down a road, one gunner, "...knocked out three Tigers--ping, ping, ping."³ One wounded officer, a veteran of Sicily, assured ordnance officers in the

¹Mayo, Battlefront, p. 149.

²Lt. Col. Albert N. Garland and Howard McGaw Smyth, Sicily and the Surrender of Italy (Washington, D.C.: OCMH, 1965), pp. 163-174.

³History of the 67th Armored Regiment (Brunswick, Germany: George Westermann, 1945), p. 235.

United States that "...he was mighty proud of his M4 tank."¹
 Clearly, experiences with German tanks at Sicily had not discouraged American soldiers. Using existing weapons, GI's had beaten the best that the Germans had thrown at them.

A clash with German armor later that year was no more enlightening. When American forces landed at Salerno in September 1943 they were in the defensive sector of the 16th Panzer Division which immediately began piecemeal attacks. The 16th Panzer Division had more than 100 Mk IV tanks, and, although it achieved some success, it had only thirty-five tanks left by the end of the first day. Americans defeated the Germans with the same combination of weapons used at Gela, including naval gunfire.² Once again there was no convincing proof that American tanks were not adequate.

Allied officers heaped praise, not criticism, on the Sherman. General Devers led a group of officers, including Barnes, who visited North Africa in December 1942 and January 1943. British Generals told the Americans that "...the M4 tank is a better tank than the best German tank."³ American troops supported those appraisals. General Devers concluded that "The M-4 medium tank (General Sherman) is the best tank on the battlefield."⁴ The opinions about the Sherman survived the later battles in North

¹Letter from Lt. Col. P.W. Gillem and Maj. D.W. Hoppock to Maj. Gen. G.M. Barnes, "Interview with Capt. Perkins at Walter Reed Hospital," dtd. 20 October 1943, OHF.

²Martin Blumenson, Salerno to Cassino (Wash., D.C.: OCMH, 1960), p. 73.

³"Ordnance Annex," Devers Report, pp. 2 and 26.

⁴Devers Report, p. 1.

Africa as evidenced by the Chief of Ordnance's testimony to Congress that "They [Shermans] overcame every tank which they opposed."¹

But Devers had no such praise for tank destroyers. He disagreed with the whole concept and disinterred the argument that had been institutionally buried by Marshall in 1941:

The separate tank destroyer arm is not a practical concept on the battlefield. Defensive antitank weapons are essentially artillery. Offensively, the weapon to beat a tank is a better tank. Sooner or later the issue between ground forces is settled in an armored battle--tank against tank. The concept of tank destroyer groups and brigades attempting to overcome equal numbers of hostile tanks is faulty unless the tank destroyers₂ are actually better tanks than those of the enemy.²

General Devers represented a significant body of opinion within the US Army. His view would become doctrine after World War II.

The tank destroyer units that participated in America's first land battle against the Germans in North Africa failed to test the concepts expressed in FM 18-5. Quite apart from the admitted inadequacies of improvised equipment, senior commanders would fail to use tank destroyer doctrine. This continual misemployment would make the performance of tank destroyer units unimpressive. In contrast, commanders would come to believe that the British and Germans had discovered an antidote to tanks--concealed, towed guns. This would ultimately force the Tank Destroyer Center to change doctrine, organization, and equipment. Tactical employment, not weapons was the main problem for tank destroyer units in North Africa.

¹Testimony of Maj. Gen. Levin H. Campbell to the House Committee on Appropriations, House of Representatives, U.S. Congress, 78th Congress, 1st Session, 9 May 1943, p. 363.

²Devers Rept., pp. 1-2.

The basic malady of the tank destroyer battalions deployed to North Africa was that commanders continually failed to employ them according to the doctrine that had governed their training and equipment. Senior officers would strongly criticize tank destroyer concepts during the campaign in Tunisia, but there was little evidence that they gave the concepts a fair test. Shortcomings of TD equipment would only add to the criticism. Missions given to tank destroyer units were often far outside the scope of their equipment or training. The doctrine for tank destroyer units, as reflected in FM 18-5, was never employed in North Africa.

Tank destroyer battalions were rarely employed as units. Tank destroyer companies, as a rule, were dispersed among larger units such as infantry regiments. The reconnaissance companies proved to be convenient for guarding the headquarters of corps commanders who seemed to be overly concerned with their own safety. The experiences of the first tank destroyer battalions to reach North Africa illustrate this point.

There were only two tank destroyer battalions, the 601st and 701st, in action in North Africa until mid-February 1943.¹ The 601st was probably the first tank destroyer unit to suffer misemployment. Originally deployed to England, the 601st quickly lost its reconnaissance company to guard the headquarters of II Corps, thus hampering the ability of the battalion to continue training. The 601st was subsequently sent to North Africa without

¹Final report of Major Allerton Cushman, dtd. 15 April 1943 (hereafter cited as Cushman Report), Intelligence Reports, Foreign Observer Reports, Folder 48, AGF files, RG 337, National Archives, p. 19 (hereafter cited as AGF Obs.).

its reconnaissance company. It was assigned, after arriving in North Africa, to the British First Army which dispersed the battalion among subordinate units. By early 1943, an observer from AGF was able to locate one company of the 601st with an American task force and another company with Combat Command B (a regiment-size unit) of the 1st Armored Division. The observer was unable to locate the remainder of the battalion.¹

A dispersed TD battalion could not fulfill the tank destroyer doctrine as discussed in Chapter II. Even if the 601st had been allowed to retain control of its TD companies, it would have been difficult to deploy those companies properly without its organic reconnaissance company. Proper reconnaissance was an imperative in FM 18-5. And breaking down the battalion into its TD companies made it totally impossible to use tank destroyer concepts.

The 701st was part of the initial landing forces in Africa. It, too, was to lose its reconnaissance company to guard a corps headquarters, and the remainder of the battalion was dispersed.² Later arrivals suffered the same fate. For example, the 805th was available at the Battle of Kassarine in February 1943 but "... was split up into companies which were destroyed in detail."³

The tank destroyer faced other problems as well. The missions assigned to the battalions or their detached companies rarely included the one mission that they were designed to accomplish,

¹Report of Colonel Thomas J. Heavey, dtd. 19 February 1943 (hereafter cited as Heavey Report) AGF Obs., Folder 1, p. 24.

²Heavey Report, p. 23.

³Cushman Report, p. 19.

i.e. being a mobile reserve intended to fight a tank penetration. Tank destroyer units received missions better suited to tanks, cavalry, or artillery. One observer reported a company of the 701st used as, "...attacking tanks and subsequently as supporting artillery."¹ Another witness affirmed that:

...they [the 601st and 701st] were generally used in roles for which they were not designed, such as infantry accompanying guns, assault artillery operating with tanks, and in cordon defense of areas instead of in depth.²

The Army's official history notes that the 601st was used as a screening force at Kassarine Pass where the battalion was nearly overrun.³ The narrative of the North African Campaign is replete with examples of ill-used tank destroyers.

One example, perhaps an extreme one, can be cited. B Company, 701st Tank Destroyer Battalion, with an attached reconnaissance platoon, operated as an independent unit during November 1942. It was ordered to attack the town of Gafsa, just after completing an overland march from Oran. The company, supported only by two antiquated, French armored cars, managed to secure the town from scattered German infantry by using tank destroyers as tanks. Warned of approaching armor, the company commander, Captain Gilbert A. Ellman, elected to meet the enemy at El Guettar where the terrain was more suitable for maneuver. B Company managed to destroy four tanks and drive off the enemy force.

¹Heavey Report, p. 23.

²Cushman Report, p. 19.

³George F. Howe, Northwest Africa: Seizing the Initiative in the West (Washington, D.C.: OCMH, 1957), p. 434.

Returning to Gafsa, the company was immediately directed to respond to an enemy attack at Sbeitla. Captain Ellman received an order to "...go up there and do something about it." Captain Ellman surprised the enemy at Sbeitla, fixed him with fire from one platoon and flanked him with another. The Italians retreated from the town after losing eleven tanks.¹

B Company had received missions far outside the intent of FM 18-5. Aggressive leadership, good tactics, and poor enemy performance enabled the unit to accomplish its missions. It should be noted that the reconnaissance platoon was instrumental to success in each of these actions. Elsewhere such offensive missions against a more determined enemy were less successful. As a witness of later actions commented:

The tank destroyer is definitely a defensive weapon. Wherever destroyers have bulged out on their own and tried to₂ fight German tanks they have been knocked out.

Their equipment and doctrine made tank destroyer units defensive organizations. As one action in North Africa demonstrated, when employed properly, tank destroyers were effective at their intended task--killing tanks.

During March 1943, the 1st Infantry Division was advancing into northern Tunisia near El Guettar. The Germans dispatched the 10th Panzer Division to counterattack.³ Maj. Gen. Terry Allen,

¹The entire narrative of B/701st TD Battalion is extracted from Captain Gilbert A. Ellman, "Gafsa and Sbeitla," TD Combat in Tunisia, dtd. January 1944, Bruce, pp. 1-16.

²Report of Maj. Gen. C.P. Hall, dtd. 7 May 1943 (hereafter cited as Hall Report) AGF Obs., Folder 49, p. 4.

³Howe, Africa, pp. 557-560 described the general situation and has some details of the action.

commander of the 1st Infantry, had ordered the 601st TD Battalion, finally assembled, to deploy into positions protecting the division artillery.¹

Reconnaissance elements of the 601st, placed well forward, detected the German attack of some 100 tanks in the early, dark hours of 23 March. Warned of the approaching armor, the 601st was able to adjust its positions which had been intended to oppose infantry. Two Tigers were among the thirty tanks knocked out by the 601st during the battle. Although the 601st lost twenty-one of thirty-one M3's, the German attack was repulsed.²

El Guettar was almost a classic example of proper employment of tank destroyers. Massing the battalion on excellent terrain had enabled it to counter a German force that out-numbered the Americans three to one. The tactics of the battalion were excellent. It had avoided both artillery and tank fire by shifting positions immediately prior to the battle and its use of covered positions for firing had kept losses from soaring higher.³

The only criticisms of the action in relation to tank destroyer doctrine were that the battalion was unduly exposed since there were no divisional units between the TD's and the enemy, and that the unit was too far forward. Preferably, according to the prescribed doctrine, the tank destroyers would have been behind the division's artillery, where they could have maneuvered

¹Lt. Col. H.D. Baker, CO, 601st TD Bn., "El Guettar," TD Combat in Tunisia, dtd. January 1944, Bruce, pp. 17-18.

²Baker, TD Combat in Tunisia, pp. 17-30. There is some confusion about the battle. Howe, Africa, claims that the 899th TD Bn was involved, but Baker does not mention this. The Cushman Report only says that a company of the 899th was sent to help.

³Baker, TD Combat in Tunisia, pp. 17-30.

to counter the tanks. Being tied to the mission of protecting artillery restricted their ability to maneuver. Neither criticism outweighed the overall advantages of a massed tank destroyer battalion screened by its own reconnaissance. The saddest thing about the tactics of El Guettar was that they were not used at Kassarine.

Despite success at El Guettar, the tank destroyer concept did not prove itself in North Africa. Maj. Gen. George S. Patton even disagreed that El Guettar was a success because of the battalion's high losses.¹ The failure of tank destroyermen to prove their doctrine to senior commanders was largely due to the failure of those same commanders to use the units properly. Several factors were probably involved in the misemployment of tank destroyer battalions.

One observer believed that the dispersal of tank destroyer units was due "...to the necessity of holding a wide front with little means."² While there is some logic in spreading assets along a wide front, it would have been just as logical to keep the tank destroyers in reserve locations to react to German penetrations on critical avenues. The desire of the commanders for a piece of the TD pie must have been strong. This tendency is common to armies and other bureaucracies.

In defense of the dispersal of tank destroyers it must be pointed out that the American forces in North Africa did not face

¹Ladislas Farago, Patton: Ordeal and Triumph (New York: Dell Publishing Co., 1963), pp. 245-246.

²Letter from Col. H.J. McChrystal to Bruce, dtd. 30 October 1943, Bruce.

German tank attacks on a daily basis. Quite reasonably, generals were probably loath to leave an important asset sitting in reserve when it could be firing on the enemy. In this light, the failure of American commanders was the refusal or inability to concentrate tank destroyers when a German tank attack was imminent or actually underway.

Contributing to the misuse of tank destroyers was the simple fact that many officers were unaware of tank destroyer doctrine. Bruce had recognized this problem, and the Tank Destroyer Center had started conducting indoctrination courses for senior officers on 30 November 1942.¹ But many of the commanders who participated in the North African campaign had already departed from the United States. Personal study or the advice of tank destroyer officers would have been their only source of education. The sudden establishment of the tank destroyers in late 1941 had not allowed time to disseminate the radical new doctrine throughout a rapidly expanding army.

Ignorance of tank destroyer doctrine was probably not as important as the fact that many important commanders simply did not agree with the concept of tank destroyers. The Army had not reached a doctrinal consensus concerning antitank warfare. Although the Antitank Conference of 1941 had demonstrated that the bureaucracy was willing to accept the mobile tank-killers, the agreement of chiefs of branches and other important bureaucrats did not necessarily represent the views of the men who would command forces in the field. With the exception of Hodges, the chiefs of branches in 1941, generally an elderly lot, were never to command theaters

¹Dunham, Study No. 29, p. 26.

or army groups. Misunderstanding of tank destroyer doctrine contributed to the opposition to tank destroyers. By 1943, General Bruce was "...distressed over the attitude of Generals Patton, Devers, Bradley, and now Lucas /Maj. Gen. John P. Lucas7."1

General Patton's objection to tank destroyers was simple: they should have been tanks. He would have preferred to replace tank destroyers with tanks. A good offense was always the best defense to Patton, and the tank destroyer was simply a poor tank. He believed that tanks could fill the need for mobile antitank guns while retaining the offensive capability of tanks.2

The views of Bradley and Lucas had a more direct impact on the tank destroyers, although their disagreement was less fundamental than Patton's or Devers'. They disagreed with self-propelled guns, although the idea of separate antitank battalions was palatable.

General Bradley was undoubtedly impressed by the effectiveness of the Germans' dug-in antitank guns in North Africa. The readily concealed German guns were effective and difficult to pry out of their positions. By January 1943, General Bradley complained about the high silhouette of the self-propelled TD's and stated his preference for towed guns that could be dug in with only their muzzles above the ground.3

¹Letter from Bruce to Pinky (Maj. Gen. Orlando Ward), dtd. 1 October 1943, Bruce.

²George S. Patton, Jr., War as I Knew It (Boston: Houghton Mifflin Co., 1947), p. 220.

³Greenfield, Organization, p. 427.

While generally in the same vein, the views of John P. Lucas were even firmer than those of Bradley. After observing the Sicilian Campaign, Lucas commented:

The Tank Destroyer has, in my opinion, failed to prove its usefulness. I made this statement not only because of the results of this campaign but also after study of the campaign in TUNISIA. I believe that the doctrine of an offensive weapon to "slug it out" with the tank is unsound. I think that the only successful anti-tank weapon is one which has a purely defensive role, has high penetrating power and, such a low silhouette that it can be concealed, dug in, and hidden by camouflage....I am of the opinion that the anti-tank weapon should be a towed gun of great power and low silhouette.¹

General Lucas' report was influential in AGF. For example, while discussing a proposed rearmament of the M10, Brigadier General John M. Lentz, the G-3 of AGF, recommended informing the Ordnance Department that "The trend is toward towed guns (quote Seventh Army Report...)." ²

Successful use of towed antitank guns by both Allied and Axis forces in North Africa contributed to the pressure for American adoption of those weapons. German tactical skill with their anti-tank guns and the legendary "88" provided ample demonstration of the effectiveness of such weapons. British success with towed weapons was probably just as influential. Soon after the American Army's debacle at Kassarine, the British soundly defeated a German thrust at Medenine. English 6-pounder antitank guns thwarted the German attack and destroyed over forty Panzers.³

¹Memo from Maj. Gen. J.P. Lucas to the Commander-in-Chief, dtd. 26 August 1943, AG 370.2, RG 407, National Archives, pp. 2-3 (hereafter cited as Seventh Army Report). This report was widely distributed in AGF and usually referred to as Seventh Army Report.

²Memo from G-3 to CG, dtd. 15 October 1943, AGF (470.8).

³Howe, Africa, pp. 514-519.

One American observer in North Africa said that it was "The best job of tank destroying that has occurred in Africa...."¹ Successful use of towed antitank guns generated pressure on the US Army to incorporate those weapons into its antitank system. Ironically, the failure of America's only towed antitank gun, the 37-mm, probably contributed to the pressure for improved guns and to the misuse of tank destroyers.

The doctrine of the tank destroyers assumed that infantry units could protect themselves from tanks and allow the TD's to remain in reserve (see page 31), available to counter major penetrations. However, the ineffectiveness of the infantry's organic antitank gun, the 37-mm, meant that the foot soldiers could not protect themselves from tanks. Morale sank. This must have put great pressure on commanders to spread tank destroyer units among the infantry units in order to give those units some protection.

There was no shortage of criticism of the 37-mm gun. A typical comment from Colonel Robert S. Miller, an observer from AGF, noted:

Two general officers condemned this gun as useless as an anti-tank weapon and strongly recommended that it be discarded. They stated that it would not penetrate the turret or front of the German medium tank, that the projectiles bounced off like marbles, and the German tanks over-run the gun positions.²

However, the same observer commented that the problems of

¹Cushman Report, p. 14.

²Report of Col. Robert S. Miller, dtd. 5 March 1943, AGF Obs., Folder 17, passim.

the 37-mm gun were not all due to the gun's performance. Colonel Miller discovered that infantry units were not placing the weapons in concealed positions where they could engage the vulnerable flanks of German tanks. Thus the 37-mm was forced to fight the frontal armor of German tanks--something that no one had ever claimed it could do. Miller, an infantryman, recommended that the gun be retained in infantry battalions while training should stress proper employment.¹ Also contributing to the general disenchantment with the 37-mm, many units were using the wrong ammunition. General Barnes, who accompanied General Devers to North Africa, discovered that about 50 percent of the 37-mm ammunition was old, semiarmor-piercing (SAP) shot. He found that the men of the units could not tell the difference between SAP rounds and later ammunition, with an armor piercing cap, that was far superior. In addition, Barnes was unable to find any of the newest 37-mm ammunition in Africa--the new M51 rounds that had increased velocity (from 2,600 fps to 2,900 fps), which made them even more potent.²

In an attempt to refurbish the image of the 37-mm, ordnance officers tested the gun with M51 rounds against two captured German tanks. They found that the Mark III's front could be penetrated at 800 yards while its flanks were vulnerable at 1,000 yards. The Mark IV's front was penetrated at 400 yards and

¹Ibid.

²"Ordnance Annex," Devers Report, p. 12.

its flanks at 850 yards.¹ But tests could not change opinions cemented by experience on the battlefield. As another observer concluded, "Confidence in the 37-mm gun as an antitank gun has been lost."²

Dissatisfaction with the 37-mm gun led to a request from General Eisenhower for the American version of the 6-pounder.³ The 6-pounder, designated the 57-mm by the US Army, was in production in the United States to meet British and Russian requirements and, thus, readily available.⁴ General McNair denied the wisdom of issuing the 57-mm because it was less mobile than the 37-mm.⁵ Hoping to replace regimental antitank companies with a TD battalion equipped with 3-inch guns, he believed that 37-mm guns supplemented by bazookas would offer sufficient close-range protection for infantry battalions.⁶ The War Department disagreed and the 57-mm antitank gun became standard equipment for infantry divisions.⁷

¹Letter from Col. D.J. Crawford to the Chief of Ordnance, dtd. 9 April 1943, OHF.

²Hall Report.

³Robert R. Palmer, Reorganization of Ground Troops for Combat, Study No. 8 (Historical Section, AGF, 1946), pp. 22 and 32.

⁴Memo from Brig. Gen. I.H. Edwards to CG, AGF dtd. 26 January 1943, and memo from G-4 to RQTS dtd. 5 February 1943, both in AGF (472).

⁵Palmer, Study No. 8, p. 22.

⁶Letter from McNair to Bruce, dtd. 2 January 1943, Bruce.

⁷Palmer, Study No. 8, p. 32.

The 37-mm gun had been no more successful in the tank destroyer units than it had been in infantry units. Indeed, the weaknesses of the 37-mm were accentuated when it was mounted in the Fargo, a three-quarter ton truck, because it was more obvious and vulnerable to enemy fire. As one observer concluded, "The sending of such a patently inadequate destroyer into combat can at best be termed a tragic mistake."¹

Although far more successful than the Fargo, the M3 also received mixed reviews. One observer reported that the "Heartiest possible praise was given to the 75-mm gun SP as an effective antitank, or tank destroying weapon."² On the other hand, General Lucas condemned the M3 because of its vulnerability.³ Reports on the M3's immediate replacement, the M10, were more encouraging.

Combat revealed that the M10 was clearly superior to the M3. The troops were satisfied with the new vehicle. Its increased firepower and greater cross-country mobility were the main sources for praise.⁴ Heavier armor and 360-degree traverse for the main gun also built confidence in the vehicle, although it lacked the mobility to outrun medium tanks.

The effectiveness of their equipment proved to be the brightest aspect of the first experiences of the tank destroyer

¹Cushman Report, p. 6.

²Heavey Report, p. 25.

³Seventh Army Report, p. 3.

⁴Cushman Report, pp. 1, 3.

units in combat. With the exception of the Fargo, the guns of the TD battalions proved capable of destroying German tanks.

The tactical employment of tank destroyers presented a less happy picture for the new units. The tactical doctrine of the tank destroyers, although never given a fair test, was condemned nonetheless by important military figures such as Generals Bradley and Devers. Success at El Guettar could not outweigh the lack of success at Kassarine and other places. In contrast, the experiences of the British and the effectiveness of German antitank weapons generated pressure to change tank destroyer doctrine, organization, and equipment.

CHAPTER V
DOCTRINE AND DEVELOPMENT: 1943-1944

During 1943 the United States Army labored to translate the lessons of its first combat experiences into improved doctrine and equipment. Written doctrine had to be revised to incorporate combat experience. One product of this experience, the demand for towed guns, forced the Tank Destroyer Command to change its organizations to accept the new weapon. Adoption of towed guns also affected development since this weapon needed improvements to meet the Tank Destroyer Command's standards.

Developing better weapons continued to absorb a great deal of attention from the Tank Destroyer Command. The Command pressed on with the T70 and finally put that vehicle into production. The appearance of heavy German tanks such as the Tiger and Ferdinand persuaded AGF to produce a heavier antitank weapon, the 90-mm gun. Technical problems slowed and complicated development efforts. Not surprisingly, rewriting doctrine proved simpler than developing equipment.

Experience in combat created pressure to revise the doctrine of tank destroyers. Significantly, the so-called "lessons" from the front were not solely those perceived by individuals within the Tank Destroyer Command. The officers at Fort Hood, for example, believed that tank destroyers had suffered from misuse and expedient equipment, not bad doctrine. However, the

Command began revisions to modify its doctrine during the summer of 1943. As the Center's history indicates, "The revision of FM 18-5 was undertaken to bring tank destroyer doctrine into conformity with the lessons of combat in Africa as interpreted by higher headquarters."¹

The frequent attachment of tank destroyer battalions in North Africa to divisions or smaller units was reflected in the new manual. While the 1942 version allotted only five pages to the topic of supporting divisions, the 1944 edition devoted twenty-one pages, with diagrams, to the subject. More significantly, the tank destroyers attached to infantry divisions assumed the role of protecting friendly infantry by repelling the enemy's initial attack rather than his breakthrough, something which had been avoided in 1942. Tank Destroyer battalions belonging to the corps or army retained the mission of mobile defense.² With the Tank Destroyer Command now willing to help TD battalions cope with the realities of tank destroyer employment, the officers at Fort Hood were forced to make other changes to their doctrine.

Tank destroyers in North Africa were often accused of chasing or hunting tanks. This was a false criticism as far as General Bruce was concerned. He complained:

I believe that many reports from higher headquarters about tank destroyers chasing tanks are based on the fact that one platoon of three guns did attempt to chase tanks, the lieutenant commanding admitting his error.³

¹Dunham, Study No. 29, p. 35.

²FM 18-5, 42, pp. 107-112 and FM 18-5, 44, pp. 72-93.

³Letter from Bruce to McNair, dtd. 5 June 1943, Bruce.

But the new field manual emphasized that, "Tank destroyers ambush hostile tanks, but do not charge nor chase them."¹

Further, the aggressive "fire and movement" tactics of the first manual almost disappeared in its revision.² But the most drastic changes in doctrine resulted from the inclusion of towed weapons, which were never in favor at Fort Hood. Reflecting the new weapons, FM 18-5 outlined an appropriate doctrine for towed battalions.

In general, the employment of towed units was the same as that for self-propelled. The basic concept of mobile guns employed in mass remained the same. When towed battalions were specifically mentioned, it was usually to point out their limitations. For example, while self-propelled companies could withdraw under fire, FM 18-5 cautioned that "Daylight withdrawals of towed units are likely to result in heavy casualties...."³ Towed guns were deemed superior for advanced positions. This was probably due to the fact that a towed gun, when dug-in, was less likely to be observed than a self-propelled weapon. Doctrine for towed units was based primarily on experience with such units at Fort Hood.⁴

The failure of the Cletrac had breathed new life into the towed 3-inch gun. On 22 August 1942, AGF directed the Tank Destroyer Center to restudy the matter of towed mounts. Towed guns, noted AGF, could be unloaded at places where docking facilities were too limited to handle the 30-ton M10. With the demise

¹FM 18-5, 44, pp. 5, 76-79.

²In FM 18-5, 42, p. 20 and several later references are devoted to fire and movement while FM 18-5, 44, p. 59 uses the term only once.

³FM 18-5, 44, pp. 6 and 57.

⁴Dunham, Study No. 29, p. 30.

of the Cletrac, the towed gun was the only alternative that could provide a version of the desirable 3-inch gun lighter than 30 tons. AGF pointed out that it contemplated organizing a number of towed battalions and therefore directed the Center to develop a tentative plan for a towed battalion.¹ Thus, lack of a really good self-propelled gun rather than combat experience kept the towed 3-inch gun alive during 1942.

After studying the matter, Bruce remained opposed to towed battalions. He believed that a towed battalion needed 300 more men than a self-propelled unit which already had 800. He pointed out that a prime mover and gun required more shipping space than a self-propelled weapon. Instead of the towed gun, Bruce recommended adapting the M3 so that its 75-mm gun could be shipped separately from the half-track. The half-track and gun could then be reassembled and employed until facilities were available to land heavier tank destroyers.² Opinions from the field would overrule Bruce.

Based on comments from North Africa, AGF directed the Command on 1 January 1943 to test a towed tank destroyer battalion. Personnel of the 801st TD Battalion conducted extensive field tests during January and February which resulted in a tentative organization on 12 March.³ Maintaining momentum, AGF ordered fifteen self-propelled battalions converted to towed units on 31 March as a tentative measure for training. On 7 May, the War

¹Letter from HQ, AGF to CG, Tank Destroyer Center, dtd. 22 August 1942; quoted in "Heavy Antitank Carriages," April 1944, OHF.

²Letter from Bruce to CG, AGF, dtd. 9 October 1942, AGF (472.1).

³Dunham, Study No. 29, p. 30.

Department issued a table of organization for the towed battalion and officially authorized the new unit.¹

The organization of the towed battalion was essentially the same as for the self-propelled unit. Elimination of one reconnaissance platoon and the inclusion of the remainder of those platoons in the headquarters company were the main adjustments. In addition, both the gun crews and the security sections were enlarged.² The lost reconnaissance platoon was probably the price that Bruce had to pay for the gun crews and security sections in order to keep the battalion down to a manageable size (about 850 men).

While the creation of a towed battalion was probably the most significant organizational change for tank destroyers, the measure had been preceded by other changes. As a result of the AGF decision during July 1942 to convert all TD units to 3-inch guns, the Command submitted a table of organization on 9 November 1942 that substituted another heavy gun platoon for the light gun platoon in each company. The only battalions that employed the light platoons in combat were the first two units in North Africa.

On 12 November 1942, AGF directed the Tank Destroyer Command, along with all other commands subordinate to AGF, to reduce all organizations by 15 percent in personnel and 20 percent in motor transportation. The biggest cuts were made against administration and supply elements. The War Department's new tables, published on 27 January 1943, eliminated some tactical vehicles, including

¹Dunham, Study No. 29, p. 30.

²TDC Hist. I, Chap. I, p. 30.

the antiaircraft section.¹

While the adjustments to tables of organization resulting from General McNair's effort to economize on manpower proved to be acceptable, the towed units remained controversial. A year after the War Department authorized such units some officers still condemned them as "worthless." But the Tank Destroyer Board noted that preferences for self-propelled over towed guns stood at about eight to five. Since this was approximately the ratio of units self-propelled to towed furnished to the theaters by the summer of 1944, it seemed to justify both types of equipment.²

General McNair had resisted moves to have all tank destroyer units converted to towed guns. He believed that the combat experiences in North Africa had not been conclusive concerning the matter. Unless further experience justified a change, he remained convinced that both towed and self-propelled weapons should be supplied.³ After General McNair personally coordinated the matter with Operations and Plans Division of the War Department, which had obvious interest in the equipment of combat units, the latter agreed in November 1943 that half the battalions should be self-propelled and half towed.⁴ The process of converting self-propelled battalions in the United States to towed guns was well under way by that time. An important part of that effort was devoted to the gun itself.

¹TDC Hist. I, Chap. I, p. 30.

²TDC Hist. III, Chap. II, p. 4.

³Letter from McNair to Bruce, dtd. 11 June 1943, Bruce.

⁴Greenfield, Organization, p. 427.

Faced with the reality of towed battalions, the Tank Destroyer Center began serious efforts to develop the 3-inch gun. The 3-inch gun had been standardized as the M1 in December 1941, prior to the completion of service tests.¹ Not surprisingly, service tests discovered many defects in the 3-inch gun. Although opposition to towed weapons from the Tank Destroyer Command had been the principal reason that the 3-inch gun was cancelled in the summer of 1942, SOS noted several deficiencies in the weapon and concluded that, "In general, [the] carriage is not properly designed to accommodate the gun."² But the failure of the Cletrac convinced AGF to ask for production of 500 3-inch guns on 23 August 1942.³ Lack of participation of the Tank Destroyer Center in the development of the 3-inch gun up to that time is evident from the fact that no example of the gun was shipped to Fort Hood until 25 August 1942.⁴

The deficiencies of the M1 proved to be curable. A new traversing mechanism cured one of the main problems of the prototype gun.⁵ Field modifications eliminated other problems,

¹Item 17545 dtd. 7 November 1941, OCM, with indorsement from the War Dept. dtd. 10 December 1941, in "History of the 3-inch Gun Carriage M1, M1A1 and M6," OHF. This collection is like the T20 Hist. and will be cited the same way.

²Letter from HQ, SOS to Chief of Ordnance, dtd. 26 July 1942, 3-inch Hist.

³Letter from HQ, AGF to CG, SOS, dtd. 23 August 1942, 3-inch Hist.

⁴3-inch Chron., 25 August 1942.

⁵3-inch Chron., 27 August 1942.

primarily a poor sight and the tendency of the gun to jump when fired. The resulting weapon was standardized as the M1A1.¹

Development work continued at Fort Hood through 1943. The Tank Destroyer Board went beyond correcting technical deficiencies and began adapting the gun to tank destroyer tactics. The M6 was standardized in November 1943.² The most visible change was a large, sloping gunshield. In addition, ten other significant modifications were developed by the Tank Destroyer Board including firing segments which raised the gun's wheels off the ground for firing and a small wheel on the trail to aid traversing the weapon.³ By February 1944, AGF was impressed enough to comment that, "...the redesign of the 3" Gun Carriage M1 into the 3" Gun Carriage M6 has resulted in an excellent towed tank destroyer weapon."⁴

One thousand M1 guns were manufactured before the M6 was perfected. AGF asked that all M1's be converted to M6's and requested 500 more M6's. The M1's had to be modified at the factory. Ultimately all units departing the United States were equipped with the M6.⁵ While it must have been galling for the men of the Tank Destroyer Command to work so hard on a weapon that

¹OCM item 22132, dtd. 18 November 1943, appended to "Heavy Antitank Carriages," April 1944, OHF.

²Ibid.

³Study No. 29, pp. 65-67.

⁴3-Inch Chron., 1 February 1944.

⁵"Heavy Antitank Carriages," pp. 3-4.

they did not want, they must have been cheered by progress with a weapon they did want, the T70.

Shortly following the Palmer Board, the Ordnance Committee approved the development of the T70 on 4 January 1943 and approved the production of six pilot models.¹ Uncharacteristically, AGF requested production of 1,000 T70's only two days later. AGF rarely requested production of any major item of equipment before a prototype existed and preferred to wait until service tests were completed. Justifying its action, AGF commented:

It is recognized that all of the modifications have not as yet been tested, however, the lack of a satisfactory tank destroyer gun motor carriage makes imperative the expediting of the production of the Gun Carriage, T-70.²

Apparently, AGF was trying to support General Bruce who continually complained about expedients and the lack of a suitable tank destroyer. But this swift decision led to a misunderstanding between AGF and Bruce.

The Tank Destroyer Center wanted to continue improving the design as studies progressed in order to build the best possible vehicle. On the other hand, AGF believed that the design should be frozen as quickly as possible in order to start production. As General Moore commented in reaction to some changes proposed by the Tank Destroyer Center, "I think Bruce should be given emphatic instructions to finalize the design of this vehicle at once." General McNair settled the problem during a telephone

¹Item 19438, dtd. 4 January 1944, OCM.

²Letter from HQ, AGF to CG, SOS, dtd. 6 January 1943, AGF (473).

conversation with Bruce who assured the former that the proposed changes were only inquiries and that any recommendations for modification would be coordinated with AGF.¹ It was not surprising that a vehicle placed into production so hastily would require many changes.

When the first pilot models reached Fort Hood there were serious problems. Most important, the T70 could not negotiate a 30 degree slope because the engine was underpowered and the torquomatic transmission slipped excessively. Installing a more powerful engine and modifying the transmission allowed the 20-ton vehicle to meet minimum requirements.²

Despite problems, the T70, enthusiastically named Hellcat by the Tank Destroyer Center, went into production during the fall of 1943. Service tests revealed a host of new problems. The most serious faults were an undependable starter and various weak points in the suspension. As testing revealed defects the manufacturer applied modifications to vehicles still on the production lines.³ The earliest vehicles grew increasingly

¹Letter from Brig. Gen. J. Christmas, Tank-Auto. Center to CG, SOS, dtd. 15 February 1943 accompanied by AGF memo slip with entries RQT to CG, dtd. 22 February 1943 and CG to RQT, dtd. 23 February 1945, AGF (473). Parenthetically, an interesting point in Christmas' letter points out the willingness of manufacturers to engage in a little war-profiteering. The transmission manufacturer (unnamed by Christmas) demanded 176 machine tools, extremely critical items, but settled for 9 after being informed that an alternate manufacturer existed.

²Maj. D.L. McCaskey, "The Role of Army Ground Forces in the Development of Equipment," Study No. 34. Historical Section, AGF, 1946, p. 65, and TDC Hist. II, Chap. II, p. 3.

³McCaskey, Study No. 34, p. 65, and letter from Tank-Auto. Center to Chief of Ord., dtd. 7 December 1943, AGF (473).

obsolete as production continued while more and more modifications became necessary. By early 1944 the situation was chaotic. There were over 1,000 T70's in existence in varying states of modification.

To settle the matter, the Ordnance Department met on 5 February 1944 with representatives of the Ordnance Department, AGF, and the General Staff present. All vehicles below serial number 658 would be returned to the factory for modification, and the rest would be modified in the field.¹ On 17 February 1944, the T70 was standardized as the M18. By this time, 1,200 had been produced; 1,097 of them required modification to meet the characteristics of the standard vehicle.²

Under these conditions, the development time of the Hellcat looked phenomenally good when viewed against the normal progress of other innovations. In just over two years, the M18 sped from conception to standardization. This record is better than that of any other armored fighting vehicle produced by the United States during World War II and may well be better than that of any other country. Rated at 50 miles per hour, the Hellcat was the fastest tracked combat vehicle in any army. Moreover, it pioneered such important features as torsion bars and the torque-matic transmission.³ But the Hellcat's 76-mm gun would prove

¹Letter from Chief of Ord. to CG, ASF, dtd. 15 February 1944, AGF (473).

²Letter from Maj. Gen. S.G. Henry, New Developments Division, to Deputy Chief of Staff, U.S. Army, dtd. 23 February 1944, Records of the Chief of Staff (hereafter cited as C/S), RG 165, file no. 470.8, National Archives.

³The fast development of the M18 obviously wasted funds, and such profligate spending would have been unacceptable in peacetime. This is why a cost-conscious American Army in the 1970's has adopted the policy: "Fly before you buy."

inadequate when the vehicle met German tanks after D-Day. Fortunately, by then the Tank Destroyer Command had been forced to develop a heavier weapon.

Like the 3-inch gun, the 90-mm antiaircraft gun's ballistic characteristics made it a natural antitank weapon. The higher velocity and heavier projectile that made the 90-mm gun a better antiaircraft weapon than the 3-inch gun also made it better for penetrating armor. However, the 90-mm gun was only beginning to reach antiaircraft units when the United States entered the war. Had the 90-mm gun been readily available, the 3-inch gun might never have been adapted for antitank use.

Ordnance officers initiated the development of the 90-mm antiaircraft gun mounted on the M4 tank chassis in February 1942. Formally recognizing the project on 1 July 1942, the Ordnance Technical Committee recommended development of the vehicle, designated the T53, and noted that "Reports from various sources have indicated the effectiveness of the German 88-mm aircraft (sic) gun when used as an anti-tank weapon."¹ General Moore agreed with the idea. "It's time," he said to a tank destroyer officer, "we got to thinking about our 90-mm to match this 88." He continued, "It would be fine if we could get ahead of them [the Germans] just once."² The T53 appeared to offer a speedy way to

¹Item 18495, dtd. 1 July 1942, OCM.

²Moore is quoted in a letter from Col. Ray. C. Montgomery to Bruce, undated, Bruce. From other information in the letter, its date was probably sometime in the period July to October, 1942.

produce a self-propelled, 90-mm gun since it used a maximum number of components already in production.

The decision to develop the T53 revealed a lack of analytical studies in the Army's development process. Neither the Ordnance Technical Committee or Moore mentioned any analysis, quantitative or otherwise, to justify developing the 90-mm gun as an antitank weapon. Such a study might have shown that the gun's edge in penetration over the 3-inch gun was needed to defeat some new or future German tank. But the reasoning was, apparently, that if the Germans had a big gun then we should have one, too.

In another effort to match the Germans, AGF directed the Antiaircraft Command on 25 July 1942 to study the problem of firing the 90-mm gun against ground targets. Finding that an average crew needed five to ten minutes to in place the gun with its single axle mount, the Antiaircraft Board concluded that the 90-mm gun was "undesirable" for use against mechanized targets, but the T2 gun mount then under development offered shorter emplacement times.¹

Until the T2 was completed, the T53 appeared to be the only means available to use the 90-mm gun in an antitank role. The T53 was an M4 tank chassis with a shielded, 90-mm gun perched on top similar to the T24 carriage for the 3-inch gun. Its high silhouette certainly limited its tactical usefulness. At a

¹Letter from AGF to CG, Antiaircraft Cmd., dtd. 25 July 1942 and 2d indorsement from Antiaircraft Bd. to CG, Antiaircraft Cmd., dtd. 19 August 1942, AGF (472).

conference on 24 August 1942, representatives of AGF, SOS, and the Ordnance Department agreed to produce 500 of the vehicles despite the problems.¹

General McNair had already pointed out the superiority of the 90-mm over the 3-inch gun. He wrote to Bruce in July that, "...there is a material advantage in the 90-mm so far as penetration is concerned. The trajectory seems a little flatter than that of the 3"."² General Bruce quickly complained about production of the T53 before tests at Fort Hood, commenting that, ".... the vehicle is an expedient and entirely lacks many of the major military characteristics considered essential by the TDC, in fact is a step backward rather than forward." AGF retorted that, "It is the opinion of this Headquarters that the Tank Destroyer Board will find this gun mount an adequate anti-tank weapon."³

Despite these hasty AGF assurances, the members of the Tank Destroyer Board were quick to condemn the T53 after they received an example for testing in the fall of 1942. AGF then agreed to cancel production of the T53, although they believed that development of a self-propelled mount for the 90-mm gun should continue. Antiaircraft Board tests then convinced that organization that they had no use for the weapon either. But the project was not

¹Item 18726, dtd. 26 August 1942, OCM.

²Letter from McNair to Bruce, dtd. 10 July 1942, Bruce.

³Letter from HQ, AGF to CG, TDC, dtd. 11 September 1942, AGF (472). The "Memo for record" portion of this letter quoting a letter from Bruce dtd. 1 September 1942 is the source of Bruce's comment.

terminated until 12 April 1944. By that time there were much more promising projects mounting the 90-mm gun.¹

In the fall of 1942, General Barnes had asked his engineers to study a towed antitank carriage for the 90-mm gun.² Development of the weapon proceeded very slowly. The idea was not presented to the Ordnance Committee until 22 March 1943, when only a sketch of the proposed gun was available.³ Formal approval of the project came on 29 April 1943.⁴ AGF commented to the Tank Destroyer Command that "...the studies are only in the first stages of development...."⁵

The lack of progress was surprising. It was not a major development program, and AGF supported it. Ordnance sketches envisaged modifying the carriage and recoil system of the M2, 105-mm howitzer, to mount the 90-mm gun. This was the same approach that had delivered the M6 towed gun. Protection for the carriage would be provided by adapting the gunshield of the M6.⁶ This apparently straightforward adaptation would prove to be very difficult for ordnance engineers and ultimately added fuel to the disputes between the Ordnance Department and AGF.

¹Item 23745, dtd. 12 April 1944, OCM.

²"History of the 90-mm Gun (AT), T5E2," OHF, entry for 15 September 1942 (hereafter cited as T-5 Hist.). This document is similar to the T20 Hist. and will be cited the same way.

³Item 20126, dtd. 22 March 1943, OCM.

⁴T-5 Chron., 29 April 1943.

⁵Letter from HQ, AGF to CG, TDC, dtd. 18 April 1943, AGF (472).

⁶Ibid.

The demand from overseas for towed guns made AGF an interested participant in perfecting such weapons. During October 1943, General Moore called General Barnes about the 90-mm towed mount and was assured that "...we are pushing it."¹ On 2 November 1943, AGF had submitted its own statement of military characteristics for a towed 90-mm gun which included a "blast deflector (muzzle brake)."² Responding, the Ordnance Department said that it would extend the T5 program to include the desires of AGF.³

The Ordnance Department had contracted with the Link-Belt Company to design the gun, immediately following the Ordnance Committee's approval of the project. By November 1943, the manufacturer was complaining that completion of the design was delayed because a subcontractor had failed to deliver gunshield designs.⁴ The Ordnance Department caused more delay by ordering numerous design changes, including completely new trails.⁵ Despite delays, Link-Belt managed to deliver a complete gun to Aberdeen, Maryland, in January 1944 and promised to begin production during June.⁶ Tests would prove that Link Belt had been too optimistic and development would drag on through 1944.

¹"Activities of Maj. Gen. G.M.Barnes," 1 October 1943, OHF. This is a daily record signed by Barnes. Although the official histories refer to this as the Barnes Diary it is really not a diary since it contains no personal information.

²Letter from HQ, AGF to CG, ASF, dtd. 2 November 1943, AGF (473.1).

³Letter from Office of the Chief of Ordnance to CG, ASF, 2d Ind. to letter above, dtd. 8 February 1944, AGF (473.1).

⁴Letter from Link-Belt Co. to Mr. G.W. Sullivan, Ord. Dept., dtd. 4 November 1943, T-5 Hist.

⁵Letter from Maj. S.F. Musselman to Chicago Ord. Off., dtd. 6 January 1944, T-5 Hist.

⁶T-5 Chron., 18 January 1944.

As "development" of the towed 90-mm gun continued, the Ordnance Department had already started perfecting a better self-propelled gun than the ungainly T53. While that vehicle had used the standard antiaircraft gun, it was obvious that adapting the gun to fit the turrets of tanks or tank destroyers would be more advantageous. Therefore, on 21 September 1942 Barnes directed his engineers to begin drawings for such an adaptation.¹ The Ordnance Committee approved the project on 1 October.²

Ordnance engineers accomplished the task of making the 90-mm gun suitable for vehicles by adapting it to fit the recoil system of the vehicle-mounted, 3-inch gun. Modifications included a new breech ring and machining down the outer surface of the gun barrel.³ Rapidly accomplishing the necessary work, ordnance engineers mounted the gun in an M10 tank destroyer and fired it by the end of December 1942.⁴ General Barnes recommended that the modified M10 continue development as the T71.⁵

Objections to the T71 swiftly appeared. Apparently, General Bruce viewed the vehicle as just another expedient; an expedient made worse by the fact that he disliked the M10. But AGF had already shown an interest in the development of the 90-mm gun for antitank purposes. Compromising, AGF agreed to the T71 with

¹"Chronology," History of the 90-mm Gun Motor Carriage, T-71 (M-36) entry for 21 September 1942 (hereafter cited as M-36 Hist.), OHF. This document is similar to the T20 Hist. and will be cited the same way.

²Item 21210, dtd. 10 July 1943, OCM.

³Ibid.

⁴M-36 Chron., 10 December 1942 and 28 December 1942.

⁵Item 19845, dtd. 13 January 1943, OCM.

the understanding that it was a development project intended only to secure information about the practicability of mounting the 90-mm gun on the M10. Objections from Fort Hood were obvious from the statement that:

The gun is not desired by the Tank Destroyers as a tank destroyer weapon since it is believed that the 3-inch gun has sufficient power. It is further felt that the Gun Motor Carriage, M-10, is too heavy and too slow.¹

The project soon met delays. Tests of the original mount that ended in January 1943 proved that the vehicle was unsatisfactory, principally because of the basic faults of the M10. The unbalanced turret of the M10 became excessively so with the 90-mm gun. The heavier gun clearly required power traverse. So, ordnance engineers had to start a complete development program for a new turret.²

By May 1943, a wooden mockup of the turret was completed in Detroit. In August, Colonel Joseph M. Colby, head of research and development at the Tank-Automotive Command, recommended that the T71 be standardized even though metal prototypes were still incomplete. A month later the prototype of the T71 finally arrived at Aberdeen, Maryland.³

In September, after ASF rebuffed the Ordnance Department's first request for production of the T71, Barnes began cultivating support for the vehicle. He contacted members of the Armored

¹Ibid. Memo from HQ, AGF to the Ordnance Committee, dtd. 9 February 1943, is an appendix to this OCM item.

²Item 22129, dtd. 8 November 1943, OCM.

³M-36 Chron., 10 May, 10 August, 23 August, and 13 September 1943.

Command and exhibited the vehicle to General Moore of AGF.¹
 Their favorable response encouraged Barnes to ask for production of from 500 to 1,000 T71's on 4 October 1943.²

Brig. Gen. W.F. Dean, who replaced Moore at the Requirements Section of AGF, thought that "General Barnes's recommendation is considered to have considerable merit...." Besides a superior fighting compartment and power traverse, General Dean mentioned that the T71 weighed 3,900 pounds less than the M10 since the redesigned turret eliminated the need for counterweights. And the 90-mm was better for destroying German tanks or pillboxes.³

The superiority of the 90-mm gun was not the main reason that Dean recommended producing 1,000 T71's. This course would also use excess M10 chassis already ordered or on hand and allow cutbacks in the production of the now unwanted M10's. AGF's G-3, Brig. Gen. John M. Lentz, agreed: "We have more M10's than we know what to do with...."⁴

By the fall of 1943, AGF found itself with far more tank destroyer weapons than it could use. This was primarily due to a reduction in the number of tank destroyer battalions. While McNair had wanted over 200 of them in 1942, the War Department had only authorized 144. McNair recommended in April 1943 that the

¹M-36 Chron. 21 September 1943, 22 September 1943, and 24 September 1943.

²Letter from Barnes to CG, ASF, dtd. 4 October 1943, M-36 Hist.

³Memo from Repts. 1 to G-3, CG, dtd. 9 October 1943, AGF (470.8).

⁴Memo from Repts. 1 to G-3, CG, dtd. 9 October 1943, and Memo from G-3 to CG, dtd. 15 October 1943, AGF (470.8).



Figure 10. An M10 and M36 in Germany, 1944. Source: US Army Photo.

program be reduced to 106 battalions, since there was no great demand for tank destroyers from the theaters. By October 1943 the War Department planned to cut the number to 64, but, after McNair objected, settled on 78 battalions.¹ Meanwhile, production of M10's had continued because there was no alternative weapon. In October 1943, AGF found itself with existing or projected production of 11,547 self-propelled tank destroyers--enough for over 200 battalions--and a requirement for only 2,862.²

Based on the fact that "We are over-producing on TD's," Lentz did not recommend producing 1,000 T71's.

The mobility of the T-70 precludes going to the T-71 unless the added power of the 90-mm gun is essential. It is not at this time. Conditions might change. A few heavily armed units might find employment against fixed defenses.

Despite his misgivings, Lentz concluded that, "...possible future developments of German armor, and the possible need for power against fortification,...warrant construction of a moderate number (300) of T-71's."³ General McNair agreed but felt that they would not be amiss to raise the number to 500--enough for 10 battalions and a reserve--while stopping production of M10's.⁴ On 25 October AGF requested ASF to produce 500 T71's and terminate M10 production.⁵

¹Greenfield, Organization, pp. 427-428.

²Memo from Armd. Branch, G-3 Section to G-3, dtd. 12 October 1943, AGF (470.8).

³Memo from G-3 to CG, dtd. 15 October 1943, AGF (470.8).

⁴Memo from CG to C of S, dtd. 22 October 1943, AGF (470.8).

⁵Letter from HQ, AGF to CG, ASF (2d Ind. to Barnes's letter of 4 October), dtd. 25 October 1943, AGF (470.8).

Despite the rapid approval of T71 production, the vehicle would not see action for nearly a year. Tests at Fort Knox revealed problems that demanded time-consuming modifications. The Tank Destroyer Board did not think the modified T71 "be considered suitable for use as a tank destroyer" until February 1944. So production of T71's did not begin until April.¹ In June, the T71 was standardized as the M36.² Besides being the Army's first successful version of a 90-mm antitank carriage, the M36 had also helped bring the conflict between tanks and tank destroyers to the surface. ASF had refused the first request for production of the T71 in September 1943 because the Acting Chief of Ordnance, Maj. Gen. Thomas J. Hayes, had lumped the request with a proposal to produce the T25 and T26 tanks. The tanks were the reason for ASF's refusal, not the T71.

Development of the T20's had continued rapidly during the last months of 1942, and controversy over the tanks had been boiling in 1943. By January 1943, the turret for the T23 was finished. General Electric Company completed the T23 during February and assembled the complete tank on 10 March. Five days later Barnes called Devers and invited him to see a demonstration of the T23 at General Electric's plant in Erie, Pennsylvania. General Devers' praise of the tank on 20 March encouraged Barnes enough to consider requesting production of 300 tanks for a service test. Service tests did not require that many, but Barnes

¹M-36 Chron., 6 January, 17 January, 19 February 1944, and 10 April 1944.

²Item 24985, dtd. 29 August 1944, OCM.

wanted 300 since that number would establish a production line and lead to mass production.¹

Only three days later, General Campbell sent the request for 300 tanks to General Somervell.² While waiting for Somervell's reply, Barnes arranged another "show" of his shiny, new toy. Generals Marshall, Somervell, and McNair attended the next demonstration at Erie, Pennsylvania, on 5 April.³ Apparently getting opposition from neither Marshall or McNair, Somervell approved production of 250 of the experimental tanks on 9 April.⁴

Meanwhile, other developments had led to further modification of the T20 program. In October 1942, Ordnance engineers had discovered that it might be possible to mount a 90-mm gun in equipment carrying the 3-inch gun. The discovery, which had led to the M36 tank destroyer, also concerned the T20 series since the 3-inch gun was being considered for those tanks. Barnes was interested in mounting the 90-mm in the T23 because he believed that General Campbell would not be enthusiastic about the tank unless it carried the 90-mm gun.⁵ On 24 April Barnes proposed two versions of the T23 with the 90-mm gun to the Ordnance

¹T20 Chron. Entries for 10 Jan. 1943, 27 Feb. 1943, 10 March 1943, 15 March 1943, and 20 March 1943.

²Memo from Campbell to Somervell dtd. 23 March 1943 in T20 Hist.

³T20 Chron., 5 April 1943.

⁴Memo from Maj. Gen. Lucius D. Clay, Asst. Chief of Staff for Material, ASF to Chief of Ordnance, dtd. 9 April 1943, T20 Hist., 1st Ind. of Memo from Campbell to Somervell dtd. 23 May 1943.

⁵T20 Chron., entries for 1 October 1942 and 29 March 1943.

Technical Committee. The proposal designated the two new versions as the T25 and T26. The T25 would be a T23 with the 90-mm gun, and the T26 would be a more heavily armored version of the T25.

The decision to build a more heavily armored tank revealed an interesting aspect of the thinking behind America's development process. The frontal armor of the T25 was increased from three inches to four inches to produce the T26. Justification for this thicker armor was "To provide an improved tank with armor equivalent or superior to the German Mk VI...."¹ In hindsight, it would, perhaps, have been more logical to adopt thicker armor because this would protect the tank from German guns such as the 88-mm, an example of which had been in the United States since 1942.² But the OTC stood logic on its head and specified a thickness of armor that was intended to protect a German tank from Allied antitank guns.

Both the T25 and T26 would be produced from the 250 T23's already approved in the following quantities: 200 T23's, 40 T25's, and 10 T26's. The OTC approved the measure on 6 May, and Barnes forwarded the proposal to ASF that same day.³ ASF obtained the War Department's approval on 24 May and so informed the Ordnance Department two days later.⁴ Although no AGF representative signed

¹Item 20342, dtd. 24 April 1943, OCM, copy in T20 Hist.

²Mayo, Beachhead, p. 25. An 88-mm gun arrived at Aberdeen Proving Ground in the late spring of 1942.

³Item 20342, 24 April 1943, OCM, and Memo from Maj. Gen. Barnes to CG, ASF, 6 May 1943, AGF (470.8).

⁴Memo from Asst. Chief of Staff, G-4 to CG, ASF, dtd. 24 May 1943, AGF (470.8).

the Ordnance Committee's minutes, ASF had obtained that headquarters concurrence.¹ During all this, work continued on the other tanks of the T20 series.

The T20 was complete on 10 May and running five days later. Its torsion bar sister, the T20E3, followed a month later. Ordnance had already shipped a T23 to Fort Knox on 18 April to begin testing. The T22 was less successful than the other tanks of the T20 series. A prototype was not completed until 22 May.² The transmission and auto-loading 75-mm gun proved to be very unreliable. General Barnes never tried to place the T22 into mass production, though development work was not halted until February 1944.³

As testing of the T20 and T23 progressed during July 1943, Barnes became convinced that these two tanks should be put into mass production. Believing that the M4 was rapidly becoming obsolescent, Barnes advised Moore on 22 July, that standardization and production orders for 500 T20E3's and 500 T23E3's should be

¹Memo from Clay to Chief of Ordnance, dtd. 26 May 1943, 1st Ind. to memo Barnes to CG, ASF, dtd. 6 May 1943, AGF (470.8). The condition of the documents relating to AGF's approval of the T25 and T26 in this file is quite interesting. They are attached to a cover sheet dtd. 29 November 1943, from ASF to AGF which references a phone conversation of 26 November and notes that Gen. Moore initialed the correspondence of 6 May. During the disputes in November, AGF could not remember apparently ever having approved the T25 and T26.

²T20 Chron. Entries for 30 April 1943, 10 May 1943, 15 May 1943, 22 May 1943, and 10 July 1943.

³Hunnicuttt, Pershing, pp. 62 and 68.

completed immediately to be sure that the tanks would be available by mid-1944. He wanted production orders for both types of tanks since the choice between the two different transmission systems was very uncertain. "We cannot, however, recommend," he admitted, "that we go into the torquematic or the electric, as we do not know enough about it."¹ He planned to make a choice between the two transmissions after testing had indicated a clear preference. The production orders of the tank not selected could be applied to the preferred choice, raising the latter's production to 1,000. After his informal conference with Moore on 24 July, Barnes drafted an approval for the Ordnance Committee but did not send a formal request through Campbell and ASF.²

The resulting proposal for producing the T20 and T23 surfaced as a request from Maj. Gen. John K. Christmas, Chief of the Tank-Automotive Command at Detroit, Michigan, that circulated between ASF and AGF. Christmas informed the Chief of Ordnance on 20 July that engineering studies of the T25 and T26 demonstrated that the electric drive transmission planned for the two tanks was unacceptable since it increased their weights excessively. Therefore, Christmas substituted torquematic transmissions and requested production of 50 more T23's (total: 250) to use the electric drive

¹T20 Chron., 22 July 1943.

²Draft OCM Item dtd. 24 July 1943, in T20 Hist.

transmissions already ordered.¹ On 24 July the Ordnance Department forwarded its recommendation to ASF, and the latter agency sent the document to AGF for their concurrence.² The smooth sailing that Barnes's proposals for development of the T20 had enjoyed soon ran into heavy weather.

There had been a drastic change in the tank development scene between the Ordnance Committee approval of the T23 and its variants and Barnes's proposal to produce 1,000 untested tanks. In mid-May, Devers left Fort Knox to take command of the European Theater of Operations (ETO) after its commander had died in an airplane accident. While Devers commanded the Armored Force, AGF had not been a major factor in tank development. "AGF", as Devers said, "was out of the picture."³ But after Devers departed, McNair swiftly took charge of the Armored Force. AGF was suddenly a full-fledged participant in tank development. Barnes's informal recommendation to produce new tanks had probably been normal procedure with the Armored Force. But it was a whole new ball game.

¹"For Record Only," Letter from HQ, ASF to CG, AGF, dtd. 28 July 1943, 2d Ind. to Letter from Deputy Chief of Ordnance, TAC to Chief of Ordnance, Subject: "Additional Procurement of Medium Tanks," dtd. 20 July 1943, (hereafter cited as "Additional Procurement"), Records of Army Service Forces, file no 470.8 (hereafter cited as ASF), RG 407, National Archives. An idiosyncrasy of military letters is a "For Record Only" section usually found at the bottom of a filed document. This entry is very useful and sometimes the entire history of a basic communication and its related documents can be found summarized on a single page. In this case the basic communication was not available but the "For Record Only" proved to be an adequate summary. The "For Record Only" entries can be verified by checking how different headquarters summarize a given document.

²Letter from Ordnance Office to HQ, ASF, dtd. 24 July 1943, 1st Ind. of "Additional Procurement" and Letter from HQ, ASF to CG, AGF, dtd. 28 July 1943 (2d Ind. of "Additional Procurement"), ASF.

³Devers.

AGF replied to Christmas' letter on 29 July and mentioned the informal request from Barnes for production of 500 T23E3's, noting that the request was under study by the Armored Command. Since the torquematic transmission had a definite weight advantage in the T25 and T26, officers in the Requirements Section could see no reason why it would not also have the same advantage in the T23. AGF's indorsement to Christmas' request commented that, "Pending further study, it is not believed that additional electric drive T23E3's should be ordered until the torquematic drive tank has been thoroughly tested and a definite decision reached as to which type is most desirable." In addition to its nonconcurrence, AGF acidly noted that Barnes and Christmas should coordinate their requests.¹

Embarrassed by AGF's criticism of his subordinates' lack of coordination, Maj. Gen. Lucius D. Clay, ASF's Director of Material, got into the act. His reply of 31 July to the Ordnance Department noted that "It is desired that all actions leading to commitments of this nature or magnitude be referred to this office." Since AGF refused to agree to General Christmas' proposal, Clay turned down further production of the T23 beyond the 200 already ordered.²

But unchastened Barnes sent his draft copy of the proposed Ordnance Committee Item anyway. He strongly recommended that the production of the tanks (T20E3 and T23E3) mentioned in the draft

¹Letter from HQ, AGF to CG, ASF, dtd. 29 July 1943, 3d Ind. of "Additional Procurement," ASF.

²Letter from Clay, ASF to Chief of Ordnance, dtd. 31 July 1943, 4th Ind. of "Additional Procurement," ASF.

be approved.¹ By this time, however, the matter had already been settled at a meeting between representatives of AGF, Armored Command, and the Ordnance Department.

On 11 August, the Chief of Ordnance met with General Moore and General Gillem, Commander at Fort Knox. AGF agreed to the production of fifty more T23's. The material had been ordered and some parts fabricated. But it did not desire to standardize any tanks of the T20 series without additional tests that would clearly demonstrate the advantages of those tanks over the M4. General Gillem had noted that the T23 was insufficiently tested and the Armored Board had had no opportunity to test the T20E3. But AGF did not oppose further development efforts. "Undoubtedly," it noted, "if we can make better tanks, they should be placed in the battlefield as soon as practicable; hence, development and tests should be prosecuted at the greatest practicable speed."² AGF had consistently supported developmental efforts but acquiescing to mass production of untried vehicles was another matter. The attitude of AGF was not surprising after the expensive and embarrassing lesson about hasty production orders derived from experience with the M7. Undoubtedly, the events of March 1943 had made AGF more cautious in July.

By mid-1943, the stage was set for the development process during the remainder of the war. The Tank Destroyer Center had finally selected its "ideal" weapon, the T70, and would spend the

¹Letter from Barnes to HQ, ASF, dtd. 12 August 1943, 5th Ind. of "Additional Procurement," ASF.

²Letter from HQ, AGF to CG, ASF, dtd. 19 August 1943, ASF.

rest of the year perfecting it. Satisfaction with the T70 and Bruce's departure marked the end of the disputes between the Center and Ordnance. Initiative for new tank destroyers would shift from Camp Hood to the War College. There, McNair still believed that tank destroyers--not tanks--were the proper antidote to German tanks. This would affect tank development since he now represented the users.

The T20 series became the focus of tank development. The failure of the M7 ended the Armored Force's only project to replace the Sherman. This left the ordnance engineers' T20's as the only alternative short of going back to the drawing board. There was no time to begin anew. Devers, apparently, had been satisfied with the T23. But he left for England in May.

CHAPTER VI
DEVELOPMENT: 1943-1944

After May 1943, McNair's opinions concerning both tanks and armor doctrine would prevail over those of the Armored Command. AGF had only been an observer and consultant before Devers departed the scene. But after he left, AGF, not the Armored Command, would represent the user's point of view in the development process. This would lead to disputes between AGF and the Ordnance Department. Misunderstandings over a towed, 90-mm gun for tank destroyer units made their relations even worse. But arguments about tanks dominated the scene. Barnes, with the aid of Devers and the British, would ultimately win and see the T26 put into mass production. The rejection of his proposal of July 1943 to build 1,000 untested tanks was only the first of many rebuffs.

Subsequent tests clearly showed that AGF's decision in July 1943 to oppose production of the T20E3 and T23E3 was correct. By 2 August, Colby called Barnes to complain about the effort to standardize the T20E3. Colby recommended emphasizing the T25 since, "They cannot keep the transmissions running in the T20E3."¹ Ordnance engineers never did get the transmission running. To propel the T25 and T26, the engineers apparently adapted the

¹T20 Chron., 2 August 1943.

successful torquematic transmission of the M18 tank destroyer which, fortunately, proved able to handle the torque of the tanks' more powerful engine.¹ The T20E3 was subsequently dropped by the Ordnance Department and none, except for the prototype, were produced. Since production orders for the T23 were already approved, it enjoyed a longer career.

Most of AGF and Armored criticism of the T23 arose from the tank's electric drive transmission. The possibilities of the electric drive fascinated Ordnance officers. Electric drives were unusual in land vehicles, diesel-electric train locomotives being an exception. The electric drive used a normal reciprocating engine to generate electricity which powered two traction motors, one for each track. Using electricity gave the system an infinitely variable range of speeds without the necessity of shifting gears. Greater mobility was obtained by the availability of continuous power, avoiding situations such as the one encountered when trying to begin moving from a stoplight on a hill with an auto equipped with a standard transmission. The two electric motors could also turn the tracks in different directions at the same time. This allowed the tank to pivot within its own length, a capability beyond most mechanical transmissions of the day. In addition, the reciprocating engine could be run constantly at its most efficient speed since power changes were reflected by changing the engine's load but not its speed. The only theoretical problem posed by the electric drive was its extra

¹This matter is not entirely clear. Hunnicutt, Pershing does not explain how the transmission problems were corrected, but the Draft OCM item of 24 July and T20 Chron. entry for 2 August both mention substituting the T70 transmission.

weight when compared to other transmissions. This amounted to nearly 2 tons in the 35-ton T23.¹ Despite the theoretical advantages mentioned above, testing at Fort Knox revealed compelling disadvantages.

Armored Command and AGF officers became increasingly less enthusiastic about the T23 as they observed it at Fort Knox. The extra weight of the electric drive badly overloaded the T23's suspension, which was the same as the Sherman's. Suspension problems were amplified since the electric drive concentrated weight at the rear of the vehicle. Furthermore, the electric drive required more maintenance than the M4. The electric drive was completely unfamiliar to Army mechanics, compounding the maintenance problem. Adoption of the T23 would have made it necessary for the Army to train a large number of specially qualified mechanics and make sure they arrived at units equipped with the T23, all at a time when AGF was feverishly struggling to organize and train units for the forthcoming invasion of Europe. After combat operations in Northwest Europe emphasized the necessity of close cooperation between tanks and infantry, the T23 presented still another problem. The tank could not be operated at speeds less than 10 mph without damaging the traction motors.² Easily the clearest tactical lesson learned by the US Army during World War II, and still doctrine in the 1970's, was that infantry and tanks must habitually work together, but the T23 would have

¹ Mayo, Battlefront, p. 330.

² Memo from CG, AGF to Chief of Staff, U.S. Army, dtd. 11 January 1943, AGF (470.8).

made such cooperation extremely difficult. Developers of tanks in several countries tried and discarded the electric drive; there are no modern tanks with it. As Colonel George M. Dean, of AGF's Requirements Section, finally put it: "The AGF would not accept the electric drive until it proved itself in service tests--it never did."¹ In 1943, however, the primary reason that AGF and the Armored Command opposed the T23 was that it had no convincing advantages over the Sherman.

The disputes over the T23 revealed the complexities of designing a major item of equipment. The tank was not simply a weapon; it was a weapons system. The men involved in tank development during World War II realized this although they lacked the obfuscating jargon of Systems Analysis. A weapon might be defined as an item that has only one function. Using a cannon as an example, as soon as the user selected the projectile's size and how far it must be thrown then the designer's problem became the relatively simple one of creating the most efficient design that satisfied the user's demand. In contrast, the tank incorporated different functions. As General Harmon emphasized, tanks must blend "gunpower, maneuverability and armor protection."² These different features had to be compromised since an increase in one dictated a decrease in the others. Disagreements over how the different characteristics should be balanced were

¹Statement of Col. George M. Dean, dtd. 18 Oct. 1945 (hereafter cited as Dean, Statement), AGF (470.8).

²Letter from Harmon to CG, NATOUSA, dtd. 14 October 1943, op. cit. Maj. Gen. Ernest N. Harmon was commander of the 1st Armored Division and former member of the Armored Force.

the root of the disputes over tank development during World War II. Because of its exploitation doctrine, AGF steadfastly emphasized maneuverability. The Armored Force agreed although they shifted towards gunpower as the war progressed. The Ordnance Department shifted from maneuverability to gunpower and armor during 1943. This would result in a clash with AGF.

Equally important, AGF realized that the tank was only part of a total system while the Ordnance Department did not appreciate this fact. Any tank, no matter how refined, depended on crews and mechanics trained by AGF plus spare parts supplied by ASF.¹ The problems of training men to operate and maintain a new tank coupled with a new, different set of repair parts to burden the logistics system all served to diminish enthusiasm for the T23. Since the T23 had no convincing advantages over the Sherman, AGF was unwilling to shoulder its additional burdens.

Combat experience during 1943, as discussed in Chapter IV, had given no cause to doubt the efficiency of the Sherman. Even General Campbell had supported the Sherman before Congress. The T23 provided no advantages that might have swayed AGF toward its adoption. Although it mounted the 76-mm gun, development efforts to mount that gun in the M4 reached fruition in August 1943. In fact, the T23's greatest asset was that its turret provided the means to mount the 76-mm gun in the Sherman. Table 2 compares

¹The question of mechanics was particularly revealing. AGF studies indicated that only the most intelligent recruits could master the repair of electrical components, and the Ground Forces stood in line behind AAF and ASF to receive such people. See Robert R. Palmer, Bell J. Wiley, and William R. Keast, The Procurement and Training of Ground Combat Troops (Washington, D.C.: Historical Division, Department of the Army, 1948), pp. 2-4 and 17 for details on the difficulties of getting intelligent recruits into AGF.

some basic characteristics of the two tanks:¹

TABLE 2

	T23	M4A3 (76-mm gun)
Armament	76-mm gun (66 rds)	76-mm gun (71 rds)
Armor:	hull front 3" @ 45°	2½" @ 47°
	turret 3½" @ 0°	3½" @ 0°
Weight	75,311 lbs.	75,175 lbs.
Height	103"	110"
Ground pressure	15.5 psi	14.6 psi
Speed	35 mph	28 mph
Maximum grade		
ascending ability	60%	60%
Range	72 mi	84 mi

From Table 2 it is obvious that the T23 had little to offer over the M4. The T23's higher road speed meant little in combat since tanks had to slow down to fight, and its armor was only marginally thicker. Higher weight and ground pressure would have increased the problems of American tankers negotiating the mud that characterized Europe in late 1944. A lower silhouette was the T23's only unquestioned advantage, but this was not enough. General McNair later summed up AGF objections on 6 December 1943:

...the medium Tank T23 as now produced is unsatisfactory as a replacement in substitute for the...M4 series....The principle shortcomings of the M4...can be attributed to the high unit ground pressure and difficulties with the suspension system....This same suspension system is now used on the T-23...and its defects are further accentuated by the increased weight of the new tank. It is believed that the proposed torsion bar suspension...will provide a satisfactory solution...however, the overall tank width is increased to 134", which is...incompatible with the requirements of standard army bridges, rail

¹Tab "A" of letter from Holly to CG, SHAEF, dtd. 15 February 1945. Records of the Armored Fighting Vehicles and Weapons Section (hereafter cited as ETO), European Theater of Operations, RG 338, National Archives.

transportation and unloading of ships. The Medium Tank T-23 then becomes a special type vehicle with greatly reduced tactical and strategic mobility and as such is not capable of replacing the M4...inasmuch as the present standard production M4...is considered satisfactory for combat it is believed preferable to delay the introduction of a replacement tank until one can be produced which corrects the principal known deficiencies now existing and that embodies all the features that have been found desirable for this type combat vehicle.¹

Before the dust settled from the dispute over the Ordnance Department proposal of July, the Armored Command had begun preparing its own recommendations for future tanks.

The Armored Command was interested in rearming the Sherman tank with bigger guns. Devers had agreed to production of twelve M4's armed with the 76-mm gun in 1942 (Chapter III), drastically paring down the Ordnance Department's enthusiastic proposal for 1,000 of those vehicles. The Armored Command tested the resulting vehicles in the spring of 1943 and found them to be unsatisfactory. This first attempt to rearm the Sherman mounted the 76-mm gun in the standard turret, and the tankers believed that it was too cramped and unbalanced. Fortunately, the T23's turret was a satisfactory mount for the gun and could be easily adapted to the Sherman. With the T23's turret the M4 (76-mm) was a success and Devers' replacement, Maj. Gen. Alvan C. Gillem, requested production of the new tank. By this time the Ordnance Department's enthusiasm for a rearmed Sherman, so evident in 1942, had waned, possibly because it would compete with the T23. General Barnes advised Colby to "...get ourselves on record as being opposed

¹Letter from CG, AGF to CG, Armored Command, dtd. 6 December 1943, AGF (470.8).

to the switch."¹ But Gillem requested production of the new Sherman on 1 September 1943.²

General Gillem's request of 1 September was intended to insure that tank armament remained suitable for armored doctrine. He had realized that the 76-mm gun was less useful for tanks in spite of its ability to penetrate more armor than the 75-mm gun. Believing that high explosive capability was more important than armor penetration, Gillem's letter was a retreat from an earlier proposal from the Armored Command that all Sherman production should consist of versions with the 76-mm gun. Gillem's original recommendation of 21 August gained concurrence from AGF, and ASF directed Campbell to terminate the production of Shermans with the 75-mm gun during December 1943 and January 1944.³ By 1 September several factors caused Gillem to modify his recommendation. The 76-mm gun was superior to the 75-mm gun only in its ability to penetrate about one inch thicker armor than the 75-mm gun. Other factors weighed heavily against the bigger gun. The larger size of 76-mm rounds reduced the amount of ammunition that could be carried in the Sherman. Despite the smaller size of the 75-mm round, its high explosive projectile carried almost twice as much explosive filler as the 76-mm projectile. Finally, the

¹Chronology, History of the M4 (76-mm gun) (hereafter cited as M4 (76-mm gun) Hist.), OHF, 4 September 1943. This document is like the T20 Hist. and will be cited the same way.

²Letter from Gillem to CG, AGF, "Subject: Employment of Medium Tank M4, Armed with the 76-mm gun, M1," (hereafter cited as "Employment"), dtd. 1 September 1943, AGF (470.8).

³"Memo for Record" on Letter from HQ, AGF to CG, ASF, dtd. 28 Sept. 1943, 5th Ind. to "Employment," AGF (470.8); and Letter from HQ, ASF to CG, AGF, dtd. 16 September 1943, 4th Ind. to "Employment," ASF.

76-mm gun had tremendous muzzle blast, and its ballistic characteristics were deemed less suitable for general use than the 75-mm's. All of the problems of the 76-mm gun convinced Gillem that only a portion of American tanks should carry the new gun. A mix of differently armed tanks would increase the ability of tank units to deal with enemy tanks while preserving their capability to engage other targets. Without specifying numbers, Gillem recommended that production schedules of the Sherman be adjusted so that ultimately a third of the tanks in American armor units would have the 76-mm gun.¹

Gillem's request sailed swiftly through AGF and ASF. By 6 September the letter was indorsed by AGF and only three days later ASF forwarded the Armored Command's recommendation to the Ordnance Department.² Apparently pleased by the success of the Armored Command's proposal to increase the armament of tanks, the Ordnance Department decided to use the request as a vehicle for their tank projects.

While agreeing with Gillem about the proper proportions for arming the Sherman, Maj. Gen. Thomas J. Hayes, Acting Chief of Ordnance, recommended large production orders for the T20 tanks and T71 tank destroyers. He asked for 500 additional T23 tanks to get "continuity of production." In addition, Hayes recommended that "...the present orders of forty T25 and ten T26

¹"Employment."

²Letter from HQ, AGF to CG, ASF, dtd. 6 September 1943, 1st Ind. to "Employment" AGF (470.8); and Letter from HQ, ASF to C. of O. (Chief of Ordnance) dtd. 9 September 1943, 2d Ind. to "Employment," ASF.



Figure 12. An M4 (76-mm) plows through French mud, 1944.
Source: US Army Photo.



Figure 13. An M4A3E8 in Germany, 1945. This is the Sherman in its final form, "Easy Eight," which includes horizontal volute spring suspension (HVSS), and 23 inch, center-guide tracks.
Source: US Army Photo.

be increased by 500 each," in order to get those tanks on the battlefield in quantity during 1944.¹ ASF rejected Hayes's request for further T20 production, although it accepted his plans to build 3,250 Shermans with the 76-mm gun. Production of the T71 was felled by the same axe. Basing its position on previous AGF opposition toward production of the T20 series, ASF commented, "The procurements recommended by the Chief of Ordnance [for T23, T25, and T26] ...have been considered in separate actions and disapproved with the concurrence of the Commanding General, Army Ground Forces."²

An official history of the Ordnance Department later implied that the T20 series was ready for production at the time of Hayes's request of 13 September and only delayed by opposition from AGF and ASF.³ This implication is false. Objections of the Armored Command and AGF to the T23 continued to increase as tests proceeded at Fort Knox. To those agencies the T23 was no more ready for production in September than it had been in July. The T25 and T26 existed only on paper. Although the T25 was further along than the T26, drafting work for the former tank was only 50 percent complete on 10 September.⁴ There is absolutely no evidence that AGF did anything to slow the design efforts of the T25 or T26, and considering the Army's organization it would have

¹Letter from Maj. Gen. T.J. Hayes, Acting Chief of Ordnance to HQ, ASF, dtd. 13 September 1943, 3d Ind. to "Employment," T20 Hist.

²Letter from HQ, ASF to CG, AGF, dtd. 16 September 1943, 4th Ind. to "Employment," ASF.

³Mayo, Beachhead, pp. 330 and 338.

⁴T20 Chron., 10 September 1943.

been amazing if AGF could have done anything to slow development efforts. In view of previous experience with ordering untested vehicles and the continuing commitment to tank destroyers, AGF's opposition to the 90-mm gunned tanks was not surprising.

Further, the opinion of the official history is not supported by experience with other tanks. The T24 light tank provides an interesting parallel to the T26. Like the T26, the T24 represented a radical departure from previous American light tanks. The T24 also used torsion bars, torquematic transmission, and the box hull. However, the light tank was a far easier proposition to design and produce than the T26 since the former could use components directly transferred from the T70 tank destroyer which had been under development for some time. Satisfaction with the T70 and the promise of the T24 led to a production order for 1,000 of the light tanks on 21 September 1943.¹ Despite this early production order, the T24 (standardized as M24) did not begin dribbling into ETO until 1945.² It seems that early production orders do not necessarily translate into an effective tank's rapid arrival at the front.

When Hayes made his recommendation to produce tanks with

¹Memo from Col. Walter P. Hensey, Jr., Supply Division G-4, to ACS, G-4, dtd. 21 September 1943, G-4 (470.8).

²Maj. Irl D. Brent, III Final Historical Report (hereafter cited as Final Report, ETO) ETO, p. 5. The exact date of the introduction of the M-24 to combat is unclear, but Brent, Final Report, ETO, states that the tanks arrived shortly ahead of training teams which arrived during March and April 1945.

90-mm guns, McNair already had a similar proposal from Gillem on his desk. General Gillem proposed to mount the 90-mm gun in the M4 by designing a new turret. He argued that combat experience had proven that American tanks sometimes had to engage German tanks in order to carry out their primary mission, and the Germans were introducing tanks with increasingly heavy armor. In order to defeat those tanks the 90-mm gun was needed and the only way to get that gun into a tank by June 1944 was to mount it in a Sherman.¹

General McNair refused Gillem's request. He argued that combat experience had shown that tanks should not engage other tanks and no theater had requested tanks with 90-mm guns. Still retaining his faith in Tank Destroyers, McNair believed that enemy armor should be the target of our own antitank guns. In addition, the Ordnance Department had convinced McNair that Gillem's idea would result in a heavy tank.²

General Barnes strongly objected to Gillem's idea. When the Armored Command contacted Barnes he replied that the Ordnance Department did not agree with the idea since it would create an "unbalanced design."³ He did not explain his objections in detail, but Gillem's proposal was an obvious rival for the T25

¹Letter from Gillem to McNair, dtd. 4 September 1943, AGF (470.81).

²Letter from McNair to Gillem, dtd. 5 October 1943 and attached memos from RQTS to CG, 16 September; CG to RQTS, G-3, 23 September; and C/S to CG, 1 October in AGF (470.81).

³M4 (76-mm gun) Chron., 13 September 1943.

and T26. While Gillem estimated that a new turret would only increase the Sherman's weight by 4,000 pounds, Ordnance officers advised AGF that the increase would be 9,200 pounds. Their data helped to convince McNair that Gillem's idea was bad.

After McNair's rebuff many officers at Fort Knox believed that Gillem should have gone to Marshall with the idea. But General Gillem, torn between desire for the tank and loyalty to his commander, elected not to go over McNair's head.¹ This marked the end of an idea that promised to provide a 90-mm tank gun to American troops during 1944.

Though the Sherman with a 90-mm gun was never produced it may be helpful to consider its feasibility. From hindsight, there were possibly two solutions to the problem.

First, the T25 turret could have been mounted in the M4. The turret rings of the M4 and T20 were the same size, 69 inches. In any case the T23 and T25 turrets were interchangeable, and the Sherman had proven capable of carrying the former. The T25 turret turned out to weigh approximately 4,000 pounds more than that of the T23. The Ordnance Department's 1943 estimates had been erroneous.² This extra 4,000 pounds would have raised the M4's weight to 37 tons, hampering its mobility. But a 42-ton version of the Sherman (the heavily armored "Jumbo") was successfully

¹Maj. Gen. (ret.) Louis T. Heath, telephone interview on 15 September 1974.

²The weight of the T25 turret is derived from the differences in unstowed weight of the T23 (HVSS) and T25 (pilot 2) from data in Hunnicutt, Pershing, pp. 211 and 212. The tanks were identical except for the T25's larger turret.

employed in Europe so the extra weight would not seem to have been disastrous. Finally, a Sherman with the T25 turret could probably have been available in 1944. Adapting the T23 turret began in July 1943, and the M4 (76-mm) entered production only seven months later. Since the T25 turret was complete in January 1944 it seems reasonable that Shermans with that turret could have been in production by September. Production experience with the M4 (76-mm) indicated that a 90-mm version could have been rapidly produced in large numbers. These tanks could probably have been available in Europe in time for the Battle of the Bulge.

The second solution to arming the Sherman might well have been quicker. The turret of the M36 could have been mounted in an M4 chassis and the vehicle issued to tankers. Such vehicles were constructed in 1944, when the Army ran short of standard M36 chassis, and standardized as the M36B1. Tankers probably would have demanded an armored top for the M36's open turret but this could have been improvised. These vehicles could have been available as soon as production of the M36 started, April 1944. Thus, they could have reached the field in the summer of 1944, possibly by D-day. Of course the M36B1 would have been an improvisation and not totally satisfactory to the Armored Command. It carried too little ammunition and a top on the M36's turret would probably have reduced the ability to depress the gun. Still, such a vehicle might have put a tank with the 90-mm gun into the hands of American troops in 1944, answering the main criticism of the Sherman. But the Armored Command and the Ordnance Department resisted improvised weapons until it was too late. Meanwhile, the British had improvised a more heavily armed Sherman and were very happy with it.

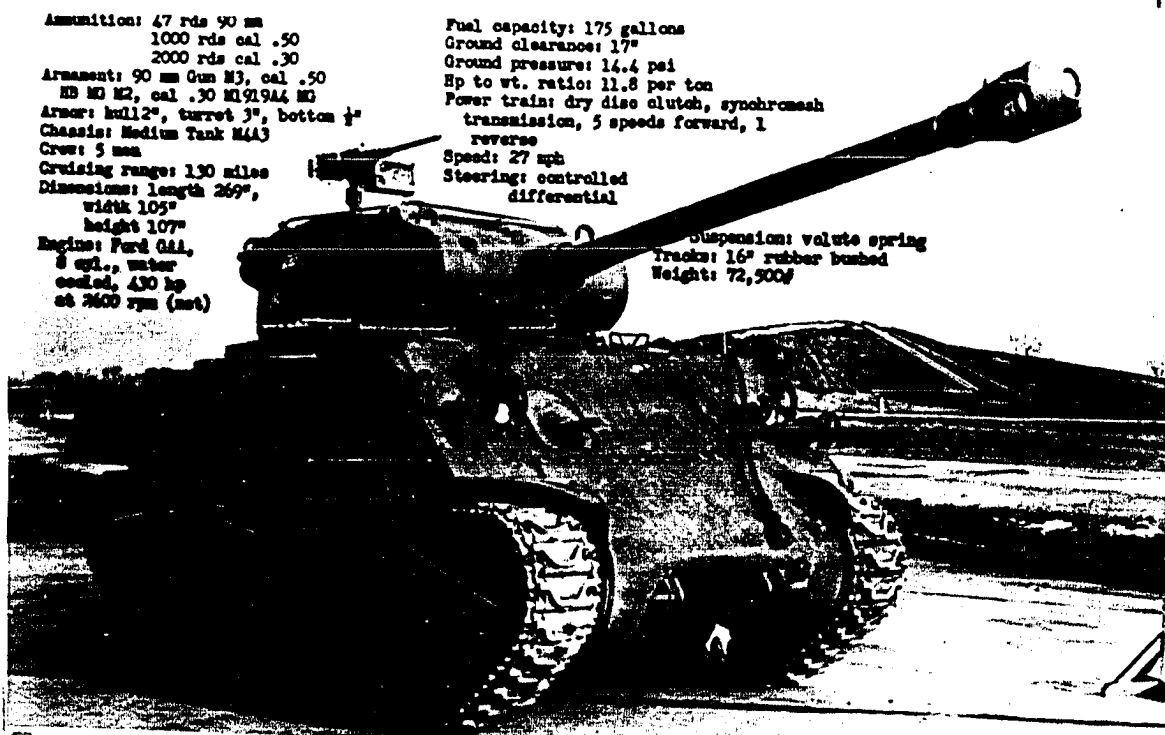


Figure 14. The M36B1. Source: M36 Hist.

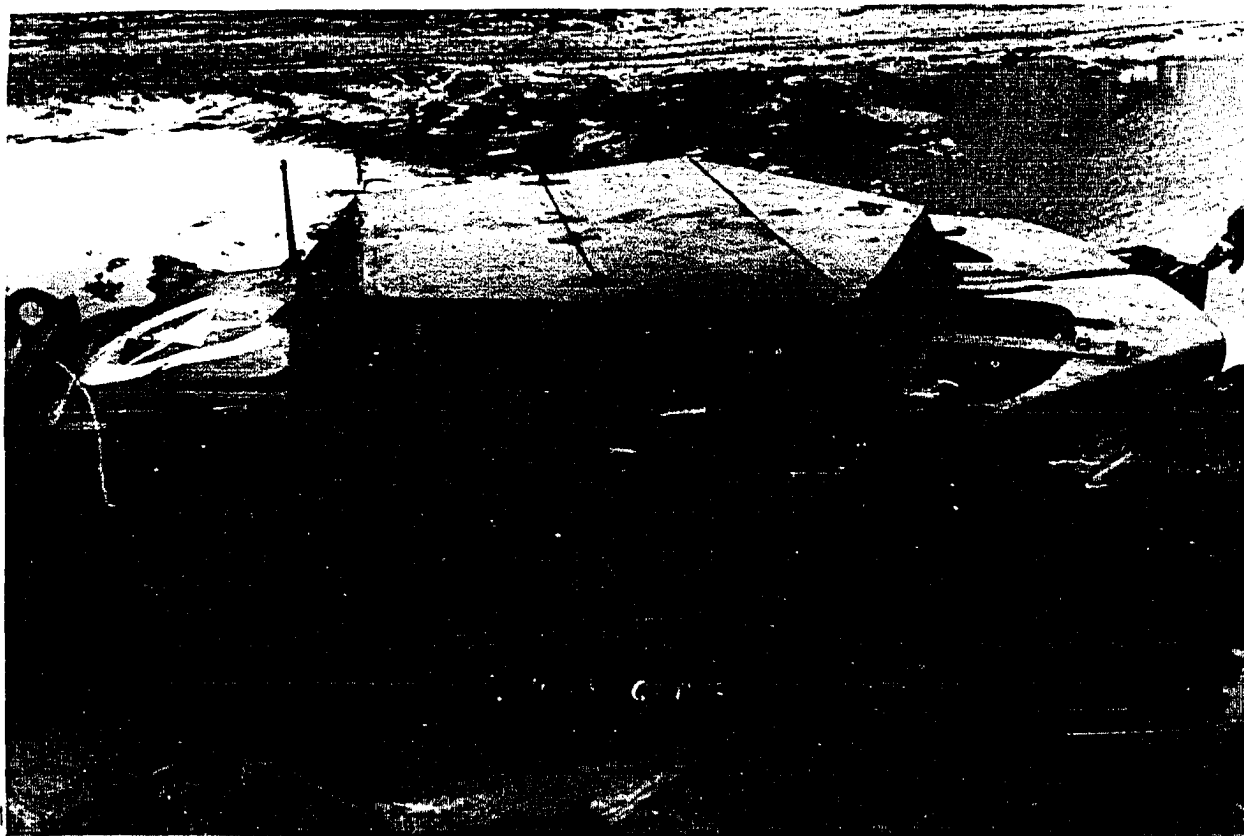


Figure 15. An M10 with an armored top improvised in France, 1945.
 Source: US Army Photo

English designers had managed to mount their excellent 17-pounder (76-mm) antitank gun in the M4's turret. The 17-pounder's ability to penetrate armor slightly exceeded that of the 90-mm gun. Hastily produced, the British managed to have this tank, named the Firefly, in their armor units prior to Normandy. They had offered the design to the United States but the Ordnance Department had sneered at it.

When first advised that the British were sending a sample Firefly to the United States, a representative of the Ordnance Department regarded it as a "nuisance."¹ Barnes disparagingly commented to Colby, after seeing the vehicle in January, that "...the position of the sight is terrible and the radio is on the outside." (The radio was placed in an armored box on the rear of the turret to save space in the tank and help counter-balance the long gun barrel.)² Later, Ordnance officers commented that it would be a "retrogression" to adopt the 17-pounder.³ Undaunted by the disdainful attitude of American ordnance officers, the British remained quite happy with the Firefly. The tank was, indeed, a less than perfect compromise. Its fighting compartment was so cramped that the assistant driver/bow gunner had to be eliminated to provide sufficient stowage for ammunition.

¹M36 Chron., 30 November 1943.

²M36 Chron., 10 January 1944.

³"Technical Information Concerning American and British Tank and Antitank Weapons and Ammunition," an inclosure to a memo from Marshall to the President of the United States, dtd. 19 July 1944, OHF.

Despite its faults, the Firefly remained the best tank-killing tank in either of the Western Allies' armies until the first dribblets of T26's appeared in 1945.

General Gillem's request for production of the 90-mm gunned Sherman exposes the main reason that neither the Ordnance Department or Armored Force felt compelled to accept any hasty improvisations in 1943. According to Gillem's figures, the 76-mm gun could penetrate the front of the German Tiger at a range of 2,000 yards.¹ The 90-mm gun's purported ability to do the same thing from 3,000 yards could not have been a very convincing argument to sway McNair toward the heavier gun since the gunsights of the day made hits at such a long range very unlikely. Gillem's figures, provided by the Ordnance Department, were fantastically optimistic. Americans in combat found that the 76-mm and 3-inch guns (same performance) might penetrate a Tiger at 50 yards but were considered to be generally ineffective against the frontal armor of the Tiger.² This misconception also explains why the men of the Tank Destroyer Command were so unenthusiastic about the M36. They considered the Hellcat's 76-mm gun to be fully adequate for dealing with German tanks. Their disastrous overconfidence in the 76-mm gun would not change until mid-1944.

Throughout the war the Ordnance Department fired its guns against nearly vertical plates of armor to establish their

¹Letter from Gillem to McNair, dtd. 4 September 1943, AGF (470.81).

²Letter from Brig. Gen. John W. Coffey, Ordnance officer of Services of Supply, NATO to Col. James L. Guion, Office of the Chief of Ordnance, dtd. 21 August 1944, OHF.

penetrative capabilities.¹ The hardness of the test plate did not match that of German armor. More important, the Ordnance Department apparently accounted for angled armor by geometrically calculating the increased effective thickness of the angled plate and, then, extrapolating a gun's penetrative ability based on firing at vertical plates, calculated its capability against slanted armor. This technique failed to account for the tendency of projectiles to ricochet from angled armor. For example, the horizontal thickness of a plate of vertical steel is doubled when the plate is slanted 60 degrees but its resistance to penetration is tripled because of ricochet.² This problem was not revealed in 1943.

General Gillem's letter also revealed another failure of technical intelligence. The two German tanks mentioned by Gillem were the Tiger and the Ferdinand. Tigers were never very numerous

¹Item 26320, 8 January 1945, OCM stated that guns were designed to penetrate plates of Class "A" (face-hardened) armor angled at 20 degrees. Heavy German tanks had homogeneous armor.

²See R.M. Ogorkiewicz, The Design and Development of Fighting Vehicles (London: MacDonald, 1965), pp. 55-66 and pp. 81-84 for an easily understood explanation of guns and the penetration of armor. The conclusion about the Ordnance Department's technique is derived from deduction since no document revealed this conclusively. Maj. Gen. William F. Dean, in AGF's Requirements section, tabulated characteristics of the Panther in a memo to McNair, dtd. 18 November 1943, AGF (470.8). He gave the thickness of the glacis plate as 3 5/16 inches angled at 57 degrees. (Later sources agree that the true figures were 3.2 inches and 55 degrees.) A diagram entitled "Penetration of U.S. Projectiles against German Pz. Kw. V "Panther" Tank and self-propelled mount "Ferdinand"--0° obliquity homogeneous plate," dtd. 1 January 1945, prepared by the Ballistic Section, Technical Division, Service Branch and approved by the Chief of Ordnance, in ETO, gives the effective thickness of the Panther's plate as 6 inches. A nearly identical thickness is derived from Dean's data and the following trigonometry:

$$\text{horizontal thickness} = \frac{\text{thickness}}{\sin (90-56) \text{ degrees}} = 6.07 \text{ inches}$$

and the Ferdinand was only a means of using ninety vehicles that Dr. Ferdinand Porsche had designed to compete with the Tiger. Although it had appeared at Kursk in July 1943, the Panther was absent from Gillem's letter. The Panther was to become Germany's most important tank and a tougher foe than the Tiger. By November a memo from Maj. Gen. William F. Dean, who replaced Moore, to McNair, demonstrated that the US Army had accurate knowledge of the tank's characteristics although Dean believed that the Germans would emphasize production of Tigers and not Panthers.¹ Still, there is no evidence that anyone in AGF wondered whether their guns were adequate to cope with the Panther.

Of the two parts of this dual failure, overestimating American guns and ignoring the Panther, the first was by far the most serious. Technical intelligence was the responsibility of the Ordnance Department, and that agency clearly failed to measure American guns against the enemy's most dangerous tank. The misunderstanding about the production of Tigers and Panthers would be corrected prior to D-Day but the weakness of American guns would not be revealed until they met the Germans. This was possibly the Ordnance Department's most serious failure during World War II. The fault was one of evaluating available information. Dean's memo showed that plenty of data arrived in time to warn American developers. But they trusted the Ordnance Department's technicians, and the error remained hidden. Had the problem been realized before the summer of 1944 developers could have hastened

¹Memo from RQTS (signed William F. Dean) to CG, dtd. 18 November 1943, AGF (470.85) (signed .8).

for cures and many things might have been possible. For example, Gillem mentioned mounting the powerful 105-mm gun on a tracked vehicle. But of course nothing such as this happened. In 1943 developers still labored in ignorance.

After helping to put an end to Gillem's idea for rearming the Sherman with the 90-mm gun, Barnes continued to try to get the heavy gun in a tank. Apparently Barnes anticipated ASF's refusal of the proposal to produce the T25 and T26. Even before Hayes' recommendation on 13 September, Barnes had already started to open other channels for production orders for the T20 series. On 4 September Barnes was visited by Gen. Alexander H. Gatehouse, a British commander famed for his experiences in the desert. General Gatehouse was very interested in obtaining heavily armored vehicles for use in Europe. Although Gatehouse was primarily interested in the T14, an experimental heavy tank being built for the British that never reached production, Barnes used the opportunity to sell the T26. He told Gatehouse that the T26 was considerably better and assured him that it would be "out" in September or October. Barnes's assurances on that point were certainly questionable. Even more amazing was Barnes's boast to Gatehouse that "...the T26 has been thoroughly tested and when it comes out, it will be foolproof." Though he did not even have a prototype of the tank that he was trying to sell, Barnes finally suggested that the British order 1,000 T26's since, "...perhaps it will suffice to wake our people up." Gatehouse, disgusted with British efforts to produce suitable tanks complained that "We can do nothing..." and agreed to act on Barnes's suggestion.¹

¹T20 Chron., 4 September 1943.

British interest in the T26 continued through the fall of 1943. Several British officers visited Barnes and on 17 October General John F. Evetts, Assistant Chief of the Imperial General Staff, told Barnes that the 90-mm gun was a "must" for battle on the continent. Barnes's confidence in the efficacy of British influence is apparent in records of his office which comment that "He [General Evetts] and General Richardson have a great deal of influence in England and may be able to help us in selling the 90-mm guns."¹ Subsequent events proved Barnes's trust to be well-founded. Meanwhile, the War Department solicited the views of American fighting men about their future requirements for tanks.

On 14 October, the G-4 of the War Department cabled all of the theaters to obtain their views on the types of tanks that they desired during 1944. The cable included descriptions of tanks under development. During the remainder of October and the first part of November, the theaters cabled their responses to the War Department. The South Pacific and Southwest Pacific Areas disagreed about the desirability of medium or light tanks but neither mentioned the T20 series. Responding on 21 October, ETO desired either the T20, T22, or T23, "...if the Armored Command accepts it after performance and gunnery tests..." and recommended further development of the T25 and T26.² However, Eisenhower, then commanding the North African Theater of Operations (NATO), preferred the "...T23 medium tank...as the T25 and T26 are considered too

¹T20 Chron., 17 October 1943.

²Memo from Brig. Gen. J.E. Hull, Acting ACS (Assistant Chief of Staff) to ACS, G-4, dtd. 18 November 1943, G-4 (470.8).

heavy." Despite favoring the T23, Eisenhower noted in his reply of 2 November that "...the present mechanical transmission has been satisfactory and if replaced by an electric drive it must be equally reliable and easily maintained...."¹ A letter to ASF on 14 November gave further emphasis to preferences in NATO. Inclosing comments from the 1st and 2d Armored Division, the only American Armored Divisions with combat experience, NATO commented that:

Of the three medium tanks described in OCM Item 20342, the T23 with the 76-mm gun is by far the most desirable. This is the general opinion expressed by armored force personnel in the theater. The high muzzle velocity of the 76-mm gun will provide the greater fire power desired in the medium tank without increasing the weight and decreasing the ammunition storage to the extent necessary if the 90-mm gun is used. The T26 tank is not favored because it is not believed that the proposed increased armor protection over that of the present M4 series of medium tanks is justified by the corresponding increase in weight and decrease in maneuverability.

The proposed electric drive is favored.../but/.... It will be noted from the inclosures that the electric drive is viewed with some skepticism.../due to/ ...fear of additional and unusual maintenance problems from a new type of equipment....If the electric drive is adopted, it must be equally as reliable as the mechanical transmission....²

General Eisenhower's recommendation was an attempt to reconcile varied opinions about new tanks.

The men in the two armored divisions had no common view about new tanks. Maj. Gen. Hugh J. Gaffey, commanding the Second Armored Division wanted the T23 with a 75-mm gun and no electric drive. His tank battalion commanders had disagreed with each other, one desired the T25 while two others argued for the

¹Ibid.

²Letter from HQ, NATO, to CG, ASF, dtd. 14 November 1943, G-4 (470.8).

T23.¹

Opinion was similarly divided in Maj. Gen. Ernest N. Harmon's First Armored Division. General Harmon leaned toward the T23 while admitting that heavier tanks might be useful, but not in armored divisions. Harmon's statement that the 76-mm gun was preferred over the 90-mm "...if the 76 can do the job" shows that ignorance of American guns versus German tanks was not confined to the United States. The commander of one of his tank regiments preferred the T25 but the other regimental commander, Col. Hamilton H. Howze, who would go on to earn four stars and fame as the developer of the airmobile concept used in Vietnam, favored the T23 saying "...the T-25 and T-26 are not worth the trouble to build." Only the executive officer of the maintenance battalion thought the T26 was any good.² Clearly, experience in battle had not produced a consensus concerning the best type of tank. Despite the lack of American support for the T26, this tank would be the one to enter production.

General Barnes's cultivation of British support for the T26 bore fruit in November. On 13 November 1943, General Devers, then commander of ETO, cabled the War Department asking that the T26 be given the highest priority and that 250 should be produced to meet his requirements. His comment that the British War Office

¹Letter from CG, 2d Armored Division to Ordnance Representative, Allied Force Headquarters, dtd. 26 October 1943 with six inclosures, G-4 (470.8).

²Letter from CG, 1st Armored Division to CG, NATOUSA, United States Army, dtd. 17 October 1943 with nine attachments, G-4 (470.8).

was going to ask for 500 of the tanks reflects British influence on his decision.¹ Besides the negative attitude of NATO toward the T26, the request from Devers for production of the tank quickly raised arguments from McNair.

In McNair's mind, he had already made a suitable response to the threat of heavier German tanks--by providing for more heavily gunned tank destroyers. He had already approved the production of the T71 and a towed 90-mm gun was under development.

Having provided a defense against the heavy new German tanks, McNair was in no mood to allow production of the T26. McNair's Requirements Section advised him of Devers' request of 18 November, remarking that it:

...intensifies the pressure upon Army Ground Forces to immediately commit ourselves to the early production of a thick-skinned tank carrying the 90-mm gun. The British and the Ordnance have been convinced for some time that we should initiate such procurement without further delay.²

General Dean recommended that AGF go on record against procuring the T26 until the pilot models had completed their service tests. Agreeing with Dean's recommendations, McNair commented that:

I see no reason to alter our previous stand... essentially that we should defeat Germany by use of the M4 series of medium tanks. There has been no factual development overseas, so far as I know, to challenge the superiority of the M4. An increase in armor or gun power can have no purpose other than to engage in tank vs. tank action--which is unsound. Moreover, such a tank would be disadvantageous in carrying out the primary mission of armor--to defeat those elements of the enemy which are vulnerable to

¹Cable from Devers to War /Department7, dtd. 13 November 1943, G-4 (470.8).

²Memo from RQTS, dtd. 19 November 1943, AGF (470.8).

tanks. The answer to heavy tanks is the tank destroyer, a 90-mm version of which we are producing to the extent of 500.¹

McNair quickly made his views known within the Army. Commenting to Marshall on 28 November about the responses from the theaters about new tanks, McNair emphasized that, "Medium-heavy tanks T25 and T26 are recommended for development only. No pilot of either model has yet been completed."² Only two days after that message, McNair re-emphasized his opposition to the T26 in a memo to Marshall about Devers' request. McNair pointed out that, "...other than this particular request--which represents the British view--there has been no call from any theater for a 90-mm tank gun."³ And he reminded Marshall of his philosophy of tank and antitank warfare to Marshall:

There can be no basis for the T26 tank other than the conception of a tank versus tank duel--which is believed unsound and unnecessary. Both British and American battle experience has demonstrated that the antitank gun in suitable numbers and disposed properly is the master of the tank. Any attempt to armor and gun tanks so as to outmatch antitank guns is foredoomed to failure. Antitank guns either must be put out by armored infantry or equivalent means, or avoided by tanks. The primary mission of tanks is the destruction of those hostile elements which are vulnerable to them--not antitank guns.

There has been no indication that the 76-mm antitank gun is inadequate against the German Mark VI tank.... Tank destroyers of either 76-mm or 90-mm caliber thus can support an armored division or other unit in whatever degree is necessary to protect them against hostile tanks, leaving the friendly tanks themselves

¹Memo from CG to RQTS, dtd. 19 November 1943, AGF (470.8).

²Memo from CG, AGF to C. of S. (Chief of Staff), U.S. Army, "Subject: Theater Requirements for New Type Tanks," dtd. 28 November 1943, AGF (470.8).

³Memo from CG, AGF to C. of S., U.S. Army, "Subject: Heavier Armament for Tanks and Self-Propelled Vehicles," dtd. 30 November 1943, AGF (470.8).

free for their proper mission. Certainly the T26 tank, weighing upwards of 43 tons, is not well adapted to the primary mission of tanks.¹

So, Devers' demand for the T26 was vehemently opposed by one of Marshall's most trusted commanders, and ASF acted quickly to resolve the dispute.

ASF sought help from the War Department on 2 December. Besides the disagreement between ETO and NATO, Maj. Gen. Joseph T. McNarney, Deputy Chief of Staff of the Army, had stated that development efforts that would exceed the Army Regulation (AR) 850-15 limitations of 124 inches in width and 35 tons gross weight should be resisted. General Clay advised the War Department that the T26 would exceed both limitations and could not cross the standard Bailey bridge. In addition, two vehicles with high firepower, the T71 and M4 (105-mm), were now on order and both vehicles could use bridges available to Armored units. In view of the divergent views, Clay asked that ASF be given further guidance.²

General McNarney queried Devers on 7 December, mentioning that development was still progressing on the T26 and, in addition, that the T71 with a 90-mm gun had already been ordered. Finally, McNarney asked Devers, "Is /your/ request for 250 T26 tanks based on an operational requirement foreseen in your theater making it desirable to place /an/ additional order prior to completion of service tests?"³

¹Ibid.

²Letter from HQ, ASF to ACS, G-4, dtd. 2 December 1943, G-4 (470.8).

³Cable from McNarney to Devers, dtd. 7 December 1943, G-4 (470.8).

Before Devers could answer, Barnes made another proposal for further production of the T20 series. His proposal came as an indorsement to ASF's request for comments on the theater's responses to the War Department queries about new tanks.¹ Barnes claimed, in his letter to ASF of 9 December, that the T23 had proven itself successful and profusely praised the tank. He said that the T25 and T26 should be produced to "...have available tanks of greater firepower and greater armor protection, should they be required."² Barnes closed his letter with a recommendation for immediate orders for 500 additional T23's, 500 T26's, and 500 T25's. ASF forwarded Barnes's proposal to the War Department on 15 December after directing the Ordnance Department to expedite production and tests of T25's and T26's already ordered.³

Devers responded to McNarney's query before Barnes's proposal reached the War Department. General Devers affirmed his request on 10 December commenting that he foresaw a "definite need" for the T26 in his theater. He said that the T26 should be given equal priority with the T71. Closing his cable, Devers recommended that, "...at least 250 T26 tanks be produced now."⁴

¹Letter from HQ, ASF to Chief of Ordnance, Tech. Div., dtd. 26 November 1943, 1st Ind. to Memo from Maxwell to CG, ASF, 1943, "Subject: Theater Requirements for New Type Tanks" (hereafter cited as "Theater"), dtd. 22 November 1943 G-4 (470.8). The "Theater" memo was sent to both ASF and AGF.

²Letter from Barnes to HQ, ASF, dtd. 9 December 1943, 2d Ind. to "Theater," G-4 (470.8).

³Memo from HQ, ASF to Chief of Ordnance, dtd. 9 December 1943 G-4 (470.8) and Letter from HQ, ASF to ACS, G-4, dtd. 15 December 1943, 2d Ind. to "Theater," ASF.

⁴Cable from Devers to War, dtd. 10 December 1943, G-4 (470.8).

The issue was soon settled, apparently by General Marshall. Loath to override the desires of commanders in the field, Marshall chose to have the T26's produced for Devers but declined to force the tanks on anyone else. On 16 December Maj. Gen. Russel L. Maxwell, the Army's G-4 and responsible for all logistical matters, wrote to Somervell that, "It is directed that immediate steps be taken to effect the early production of two hundred fifty (250) additional T26 tanks to fill the operational requirements of the Commanding General, European Theater of Operations...."¹ Marshall cabled Devers about his decision on 21 December but estimated at least a nine month delay before production could start.² Thus, despite McNair's vehement opposition and a negative response from the only theater that had experience in combat, Barnes had won a major victory for his pet project only three months after he had first proposed production.

Barnes's victory was soon challenged, however. Late in December General Devers became Deputy Commander of the North African Theater of Operations and, ultimately, commander of the invasion of Southern France. At the same time Eisenhower left the Mediterranean for England to become commander of SHAEF (Supreme Headquarters Allied Expeditionary Force) which also made him commander of ETO. Since Eisenhower had opposed the T26 in November, ASF wondered if the decision to produce it for ETO should be reconsidered. ASF also objected to the inevitable delays in

¹Memo from Maxwell to CG, ASF, dtd. 16 December 1943, G-4 (470.8).

²Cable from Marshall to Devers, dtd. 21 December 1943, G-4 (470.8).

producing the T26 since "It is...apparent that this tank will not be available for the early part of planned major operations in the European Theatre of Operations." General Clay pointed out several factors that would delay the T26 including the difficulty in establishing a facility to produce the tank's new transmission which was a "radical departure" from previous experience and "The usual difficulties attendant upon putting a pilot model into assembly line production...."¹

General Maxwell answered Clay that the delays had already been taken into consideration and brought to the attention of the Theater Commander. In addition, the inclosures attached to Eisenhower's letter of 14 November, upon which he had based his objections to the T26, did not completely reject the tank. Maxwell quoted General Harmon of the Second Armored Division:

There may be opportunities in special situations for the employment of very heavy /sic/ armed and armored tanks, therefore, a few battalions of this type should be procured, but to procure large masses of this type would be a mistake since they cannot be maneuvered or fought over the average type of terrain and in the average situation such as the Armored Division should be expected to be employed.

In a similar vein, Harmon had commented that, "The weight of both the T25 and T26 makes them undesirable types for an Armored Division, but they might well be considered for use with special GHQ tank battalions." Since the production of 250 tanks would only supply enough for about four battalions, Maxwell directed Clay to let the production order stand.²

¹Memo from Clay to ACS, G-4, dtd. 30 December 1943, G-4 (470.8).

²Memo from Maxwell to CG, ASF, dtd. 1 January 1944, G-4 (470.8).

The War Department's uncertainty about Eisenhower's views toward the T26 was swiftly eliminated. On 15 January 1944, Marshall cabled Eisenhower asking, "Has any change in this requirement arisen to make advisable delay or cancellation of project /T26 production/?"¹ General Eisenhower's response on 31 January reaffirmed the requirement and ended resistance to the production order. It is very possible that British influence was a factor in Eisenhower's decision and, thus, on tank production in the United States. On 25 January, British representatives of the International Supply Committee, acting according to instructions received from London, requested "...consideration to our requirement..." for 500 T26's.²

So, 1943's controversies finally ended. Overruled by Marshall on tank armament, McNair had made sure that his tank destroyers would also be well armed. General Barnes had finally won his battle to get production orders for the T26 but the red-penciled note of some unknown staff officer in ETO on Marshall's message about the nine month delay would prove to be prophetic: "We can forget this one."³

¹Cable from Marshall to Eisenhower, dtd. 15 January 1944, G-4 (470.8).

²Memo from Reid and Preston, British Representatives, International Supply Committee, to Director, International Aid Division, U.S. War Dept., dtd. 25 January 1944, G-4 (470.8).

³Cable from Marshall to Devers, dtd. 16 December 1943, ETO.

CHAPTER VII
COMBAT IN EUROPE: 1944

American officers' confidence in their ability to defeat German tanks remained unshaken during the spring of 1944. Continued fighting in Italy did nothing to dispel this complacency. Germany hurled both Tigers and Ferdinands at the Anzio beachhead during a major attack in February 1944, but Allied Forces beat them off. Those behemoths could not compensate for massive Allied firepower. Artillery was probably more important than tanks or tank destroyers in defeating the Germans but, once more, there was no demonstration that the latter weapons were terribly deficient.¹

After the breakout from the Anzio beachhead American forces finally encountered the Panther. It had first gone into action at Kursk in 1943. The tank does not seem to have particularly impressed United States troops. General Devers, now in the Mediterranean, commented that an M5 light tank had destroyed a Panther with its 37-mm gun by getting "...their rounds off before the lumbering Panther could swing its big gun into action."² Panthers earned more respect later as an extremely dangerous foe.

The Panther was a direct result of German 1941 experience with the Russian T-34. German soldiers had demanded something to

¹Blumenson, Salerno, pp. 420-424.

²Letter from Lt. Gen. Jacob L. Devers to Maj. Gen. Levin H. Campbell, dtd. 28 May 1944, OHF.

cope with the sturdy Russian tank, and designers began work on the Panther in 1941. They copied the sloped armor of the T-34 and added their new, long 75-mm gun (Kwk. 42). Fortunately, previous German work on the Tiger provided a sufficiently powerful engine and strong enough suspension system. The Panther's layout, engine in the rear and a mechanical transmission in the front, was in accord with previous German experience. The vehicle was in production by November 1942. The Germans hurried 250 Panthers to the front in 1943, delaying their Kursk offensive until the tanks arrived. Not surprisingly, their teething troubles were so bad that all the survivors had to be returned to their factory in Germany for major modifications.¹ The German Army was not satisfied that the Panthers' difficulties had been corrected until March 1944, and even then it remained notoriously unreliable.² Still, it could kill Sherman tanks at 2,000 yards while its frontal armor was impervious to the American 75-mm gun. This was due to the only real innovation on the Panther, its steeply sloped (55 degrees) armor, a feature to which the Western Allies had paid little attention.

The British and Americans conducted firing tests in England on 23 May 1944 to compare the 17-pounder, 90-mm, 76-mm, and 75-mm guns. But slabs of armor angled at 30 degrees gave no prediction of the success of those guns against German tanks. It reassured

¹See Walter J. Spielberger and Uwe Feist, Panther (Buena Park, Calif.: Feist Pub., 1968), Senger und Etterlin, Tanks and Green, Planning, passim for details about the Panther and German tank development.

²Green, Planning, p. 286.

the British that their gun could penetrate 120-mm of armor and showed the Americans that the 76-mm could pierce 100-mm, the thickness of the Tiger's frontal armor. The 90-mm's surprisingly bad performance was blamed on fuzes which detonated prematurely. To no one's surprise the 75-mm gun could penetrate neither of the thick slabs but this fact seemed to cause no consternation.¹

Ordnance Department data did not stir the men in Europe to do more testing. That data showed that the Panther's slanted hull was immune to frontal attack by anything but the 90-mm gun. But their data assured its reader the Panther's turret front (3.9 inches) could be penetrated by the 76-mm gun at ranges over 1,000 yards. The data failed to take into account the fact that the Panther's gunshield, which covered most of the turret's front, was sharply curved (See Figure 16). In fact, the effective thickness of the shield was 3.9 inches only at the exact apex of the curve. Hitting this precise location with an armor piercing shell would prove nearly impossible in combat. And the myth continued that the 76-mm gun could penetrate the front of the Tiger at ranges over 1,000 yards.²

¹Memo from Capt. I.D. Brent, III, to Executive Officer, AFV&W Section "Report on Comparative Firing Program Witnessed at Shoeburyness, Essex, 23 May 1944," dtd. 24 May 1944, ETO.

²Diagram entitled "Penetration of U.S. Projectiles against German Pz. Kw. V "Panther" Tank and self-propelled mount "Ferdinand"--0° obliquity homogenous plate, dtd. 1 January 1944 and Diagram entitled "Penetration of U.S. Projectiles against German Pz. Kw. IV "Special" and Pz. Kw. VI "Tiger" Tanks--0° obliquity homogenous plate," dtd. 1 January 1944, both in ETO. These are technical diagrams prepared by Ballistic Section, Technical Division, Service Branch and approved by the Chief of Ordnance.

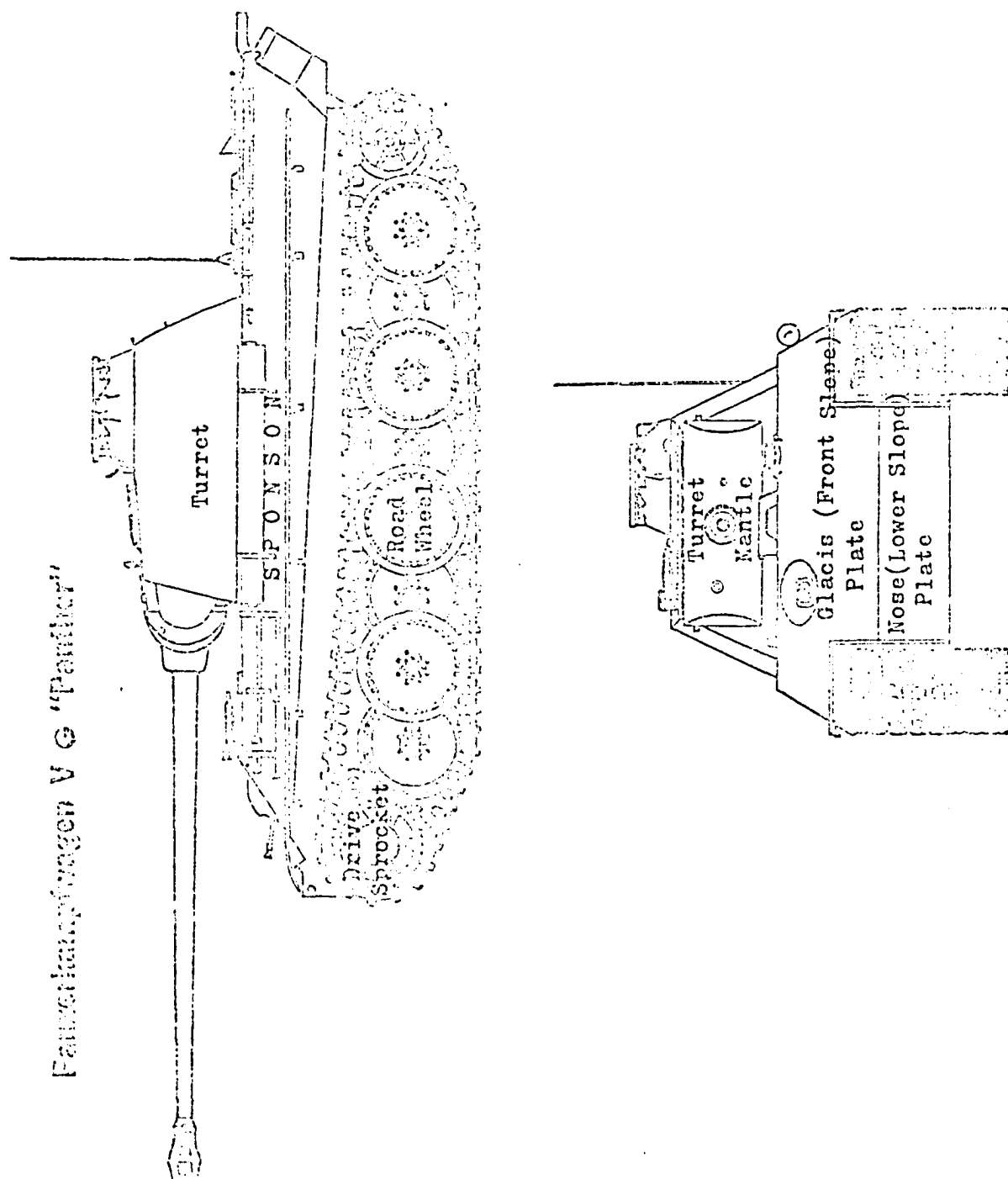


Figure 16. The Panther. Source: Feist, Panther, p. 55.

ETO officers had already indicated their lack of concern about killing German tanks. Production of the Sherman with the 76-mm gun had begun in January 1944 and at least fifteen would be available for D-Day with 600 more in June and July. On 20 April members of ETO met to discuss how the new tanks should be issued. They agreed that there was little time to train troops with them. General Gaffey, now on Patton's staff, complained that the tank had "bugs" which should be ironed out before the tank was issued. The members of the board had noted the gun's high explosive performance was inferior to the 75-mm, and its severe muzzle blast tended to make it a one-shot weapon. The test in May underlined this when they discovered that muzzle smoke (no dust) obscured the tank commander's view of a target 1,000 yards away for 3 to 6 seconds despite a stiff breeze. The Board declined to issue the new tank since training problems and muzzle blast were "...an excessive price to pay for an additional inch of armor penetration."¹

By May the theater's concern about German armor had not increased. To settle quarrels in the United States the War Department's G-4 asked ETO to specify their requirements for 1945 tank weapons. General Eisenhower responded that the theater wanted 90-mm guns and 105-mm howitzers in the ratio of one to three (1-90/3-105).² Brig. Gen. Joseph A. Holly, Eisenhower's staff agent for tank problems and formerly Devers' "engineman" for development at Fort Knox, was convinced that most tank targets

¹Capt. I.D. Brent, III, Conference Notes, "Distribution of Medium Tank, M4 Series (76-mm gun)," dtd. 20 April 1944, ETO.

²Message from Eisenhower to War, dtd. 18 May 1944, G-4 (470.8).

would be personnel, machineguns and other objects requiring a high explosive weapon. The 105-mm howitzer would fill this need. A version of the howitzer had already been mounted in a Sherman tank. General Holly held his views despite the fact that he was not deluded about the 76-mm gun. He accurately predicted that it would not penetrate the Tiger frontally, but he made no judgment about the Panther although he believed that it was one of the most important German tanks.¹ His assessment about tank armament would not change before D-Day. Equipment for tank destroyer units also reflected a lack of concern for German tanks.

Even though General Holly asked for 90-mm guns, the need for those guns to deal with heavy German tanks was not a matter of immediate concern. General Eisenhower, responding to a War Department query in May 1944, mentioned training requirements and concluded that "No T-71's M36 are desired at this time for converting Bns now under our control."² While the status of training of invasion forces was of course very important by May 1944, Eisenhower's refusal of tank destroyers with the 90-mm gun indicated that he felt no pressing need for the gun. All theater commanders agreed that they would rather receive units equipped with and thoroughly trained on new weapons than attempt to issue new weapons to units already in the field.³

¹ Memo from Holly to G-3, ETO, dtd. 2 May 1944, ETO.

² Cable from Eisenhower to War Department, dtd. 20 May 1944, AGF.

³ Memo from Maj. Gen. S.G. Henry, Director, New Developments Division to Chief of Staff, U.S. Army, dtd. 17 April 1944, C/S.

Their resistance to re-equipping units had already been made evident. The War Department had offered forty M18's to ETO in February. They were refused because the theater did not want to re-equip units at that time. The North African Theater of Operations accepted forty for shipment in March. Most of the M18's available in the United States went to fourteen tank destroyer battalions training there.¹ They would slowly reach the front as the new battalions were deployed, and only 306 (compared with 790 of the slower M10's) were in the hands of troops by 20 December 1944.²

Of course the need for the M18 was even less compelling than the need for the M36. The M18 had no more firepower than the M10 and was more lightly armored. Planners in England who had not seen the M18 would not appreciate its nimbleness until they saw it in action. In any case, the man charged with the American part of the invasion, General Bradley, preferred towed antitank guns (See page 96). Planning reflected this fact.

By 23 March 1944 there were nineteen TD battalions in England, sixteen self-propelled and three towed. Final plans intended to redress the balance of towed and self-propelled weapons, calling for 50 percent of each type. On D-Day there were nineteen self-propelled battalions and eleven towed units equipped and ready for combat.³

¹Ibid.

²Brent, Final Report, ETO, Appendix G.

³The General Board, United States Forces, European Theater, "Report on Study of Organization, Equipment, and Tactical Employment of Tank Destroyer Units," Study Number 60, dtd. 22 April 1946, Command and General Staff College Library No. R-12885.60-2, p. 1 (hereafter referred to as GB 60).

The number of tank destroyer battalions planned for the overall campaign following the invasion also indicated a declining concern for the German tank forces that had seemed so awesome in 1941. Originally, the plan called for seventy-two tank destroyer battalions. By November 1943, General Bradley approved reducing the number to fifty-two.¹

Though their numbers were reduced, the men in tank destroyer units must have been encouraged by the fact that they were to be employed according to their doctrine. Plans called for a tank destroyer group to be attached to each corps to control such varying numbers of TD battalions as the armor threat might dictate.² This idea was exactly the doctrine recommended by FM 18-5. But the Normandy countryside, compartmented by hedge-rows which were each a tank obstacle, was poorly suited for the employment of large numbers of tanks. Most of the Panzer divisions became committed against the British further to the east, and, as a result, small German tank attacks in the American sector were aimed at limited objectives. This created pressure to disperse tank destroyers among frontline units rather than leave them concentrated in reserve positions. Consequently, tank destroyer battalions were rarely attached to groups "...because of...the piecemeal employment of German armor." The various group headquarters quickly became advisory groups "...interested in seeing that the tank destroyer battalions were adequately supplied and gainfully employed."³ The concept of massing tank destroyers

¹Ibid.

²GB 60, p. 5.

³GB 60, p. 10.

succumbed to the tactical situation. It would not be revived even when needed.

The situation described above illustrates the most fundamental problem of tank destroyer doctrine and organization. They were defensive units in an army that was almost continuously on the offensive from 1942 to 1945. They never faced the massed German armor of 1940 because those formations had been bled white in Russia, and their remnants hid from Allied airpower. Commanders would become used to dispersing tank destroyer units because they had little reason to do otherwise. The effectiveness of tank destroyers would be measured by their ability to perform offensive operations which they had not been designed to do. The doctrine developed in 1941 and 1942 was usually inappropriate for the situation in 1944. Commanders in the habit of dispersing the tank destroyers would refuse to mass them even when the situation begged for it. Such a situation occurred shortly after the breakout at St. Lo.

During the first days of August 1944, American units were pouring through the gap that had been opened at St. Lo. Hoping to stem the tide and cut off a large American force, Hitler ordered an attack against the chokepoint at Avranches. The Germans assembled two corps which included four Panzer divisions for the attack.¹ Fortunately, the Allies were warned of the attack by

¹Committee 24, Officers Advanced Course, The Armored School, Employment of Four Tank Destroyer Battalions in the ETO, Fort Knox, Kentucky, May 1950, pp. 83-84 (hereafter cited as Employment).

Britain's Ultra organization which decoded German messages throughout the war.¹ Despite the warning, tank destroyers were not massed. Instead, the 30th Infantry Division and its single attached tank destroyer unit, the 823d TD Battalion with thirty-six towed guns, would meet the brunt of the German attack.

On 5 August 1944, the 30th Infantry was attached to VII Corps and ordered to relieve the 1st Infantry Division in the vicinity of Mortain.² Typically, the division ordered the 823d to attach each of its companies to a regiment of the division.³ Assured that the sector was quiet, the 823d occupied the same positions as the previous tank destroyer unit. Unfortunately, some of the positions were exposed and lacked protection from friendly infantry.⁴ Thus, when the German attack came on 7 August, it found the 823d dispersed, unprepared, and in some cases unsupported.

Receiving only 20 minutes warning from the 30th Infantry Division, the 823d came under attack during the first hour of 7 August. By daylight the German attack was well underway. The Third platoons of both A and B Companies were in exposed positions. A Company's Third Platoon, unprotected by American infantry, quickly succumbed when German troops swept around their positions

¹F.W. Winterbotham, The Ultra Secret (New York: Harper & Row, 1974), pp. 148-154.

²Employment, p. 85.

³After Action Report, 823d TD Battalion, RG 407, National Archives, 5 and 6 August 1944 (hereafter cited as AAR, 823).

⁴Employment, pp. 86-88 and AAR, 823, 7 August 1944.

and made the guns untenable with small arms fire.¹ The platoon from B Company fared little better. Although that platoon was able to kill two German tanks, "The heavy towed tank destroyer guns were sitting ducks when they revealed their locations by firing."² Other units of the 823d were more fortunate but the situation in the 30th Division's sector was very serious. As the unit's historian noted, "...with a heavy onion breath that day the Germans could have achieved their objectives."³ But at the end of the day American forces, aided by tactical airpower, had stopped the German attack.

The 823d killed fifteen German tanks but lost heavily. By the end of 7 August, the battalion lost 11 guns with their prime movers (halftracks), 3 soldiers were dead, and 101 were missing.⁴ Most of the losses came from the two platoons that had been overrun in their exposed positions.

One incident on 7 August clearly illustrates the difficulties created by commanders who failed to employ the tank destroyers as a cohesive battalion deployed defensively according to the prescribed doctrine. At about 0630 hours, the division ordered the 823d to move TD's to cover the southern flank "at once." After the battalion commander reminded the division that he had not a single tank destroyer under his control, the division gave him a platoon from C Company, which was not in contact with the enemy. However, the 119th Infantry regiment refused to release the

¹Employment, pp. 97-96.

²Employment, p. 96.

³Robert L. Hewitt, Workhorse of the Western Front--The Story of the 30th Infantry Division, p. 54 quoted in Employment, p. 99.

⁴AAR, 823, 7 August 1944.

platoon until noon.¹ Fortunately, the delay did not prove to be critical since the Germans did not materialize in the south.

The sad fate of the 823d was largely due to the immobility of its guns. Unable to fire and run, the men of the 823d stood, fought, and were overrun. Although the doctrine of FM 18-5 published in 1942 may have been inappropriate in 1944, the changes in that doctrine dictated by generals with "combat experience" would subsequently prove to be worse.

Even before the invasion the towed tank destroyer battalions that Bradley had demanded in 1943 began to fall short of expectations. Planners had hoped to attach a towed battalion to each division while retaining self-propelled battalions as corps or army reserves. This solution partially agreed with doctrine in FM 18-5 since it compensated for the lesser mobility of towed guns. Amphibious exercises prior to the invasion revised planning by revealing the vulnerability of towed weapons while unloading and going into action. Therefore, only one towed battalion was present in the initial invasion while several self-propelled units participated.²

After the invasion the limitations of towed guns became more evident. Soon after D-Day, divisions that had not been in the initial landings began requesting self-propelled tank destroyers

¹Ibid.

²GB 60, p. 10.

to replace towed units because:

(1) the organic need for an armored self-propelled assault gun in the infantry division; (2) the inability of the towed gun to shoot direct fire over the hedgerows; (3) the thin armor of the towed gun which made it impossible to push it far enough forward to take advantage of the small field of fire defined by the hedgerows; and (4) the immobility of the towed gun once emplaced.¹

The weapon that seemed so desirable in Africa became a white elephant in different terrain.

As Americans slogged through the bocage they found that the small fields surrounded by high, thick hedges compensated for the technological weakness of American tanks. The terrain resulted in short range engagements where the efficient power traverse of the Sherman was often more important than the ability of German tanks to destroy Shermans at long range. The thick vegetation sometimes obstructed the long barrels of the German cannon. "Sometimes," one American tanker commented, "we could get off three or four rounds while they [the Germans] were still traversing."² But a better traversing system could not fully compensate for the troops' difficulties with heavy German tanks, and senior commanders finally became aware of this.

Aggravated by the tough hide of the Panther tanks during the first weeks of the Normandy campaign, the First Army set about finding exactly what weapons could kill that tank. A board of officers moved a Panther to a suitable location and fired at it with virtually every weapon in the First Army that would penetrate armor: including rifle grenades, 40-mm antiaircraft guns, and

¹GB 60, p. 2.

²Interview with Col. Richard K. Lamison (formerly in 37th Tank Bn, 4th Armored Division 1944-45), Fort Knox, Kentucky, 12 February 1972 (hereafter cited as Lamison).

105-mm howitzers. The results were disheartening. Three-inch guns had a chance against the turret mantle at very short range (200 yards). Only the 90-mm gun and the 105-mm howitzer proved capable of penetrating the Panther's glacis plate. But the low velocity of the 105's shaped charge ammunition (1,020 fps) made it nearly impossible to get hits beyond 500 yards.¹ In addition, the few M4 tanks equipped with the 105-mm lacked power traverse which made their crews very hesitant to engage German tanks.² The 90-mm was credited with penetrating the Panther's front from 600 yards.

Even the 90-mm gun's ability to penetrate the Panther at 600 yards was disputed in a later test. The 703d Tank Destroyer Battalion with M36 tank destroyers firing in early December 1944 was only able to make penetrations about 50 percent of the time at ranges of 150 to 300 yards. In addition, the commander of the 703d concluded that the 90-mm was ineffective against the King Tiger's frontal armor.³ In any case, the First Army tests caused considerable excitement among senior American commanders.

Shocked by the results of the First Army's test, Eisenhower remarked angrily:

Why is it that I am always the last to hear about this stuff: Ordnance told me this 76 would take care of anything the German had.⁴ Now I find you can't knock out a damn thing with it.⁴

¹First United States Army, "Report of Proceedings of Board of Officers," Report of Operations 1 August 1944-22 February 1945, Annex 5, Appendix 2, pp. 65-66.

²Brent, Final Report, ETO, pp. 14-15.

³Letter from Lt. Col. W.E. Showalter, C.O. 703d TD Bn, to CG, First U.S. Army, dtd. 15 December 1944, ETO.

⁴Eisenhower quoted by Omar N. Bradley, A Soldier's Story (New York: Popular Library, 1964 [originally 1951]), p. 322.

General Eisenhower quickly took action to rectify the situation. He dispatched General Holly with a letter for Marshall demanding tanks and tank destroyers with 90-mm guns. General Marshall expedited shipment of M36's and assured Eisenhower that the high priority of the T26 should assure its arrival very soon.¹

General Bradley, Commander of the Twelfth Army Group, reacted by ordering that 90-mm antiaircraft guns be deployed in an antitank role. In addition, he requested British M4's with the 17-pounder (Firefly).² His request for Fireflies was unfilled since ETO would have had to provide M4's for the conversion. ETO was unable to do this because of a serious shortage of Shermans. Units were forced to operate at 75 percent to 87 percent of their strength because the War Department had earlier based replacement rates on a lower attrition factor and higher shipping speeds than what eventually transpired.³ Even the Fireflies would not have solved the problem. The 17-pounder "only nicked" the German tanks or "did not always go through."⁴ The comparison tests of the 90-mm and 17-pounder in England had shown the British weapon to be slightly superior at close ranges. This superiority was not convincing until the fall of 1944 when the English introduced sabot

¹Alfred D. Chandler, Jr., gen. ed., The Papers of Dwight D. Eisenhower, 4 vols. (Baltimore: Johns Hopkins Press, 1970), Vol. 3: The War Years, pp. 1973-1974.

²Bradley, Soldier's Story, p. 322.

³Brent, Final Report, ETO, pp. 21, 24-25.

⁴A History of the 44th Royal Tank Regiment in the War of 1939-45 (London, 1965), p. 144, and Twenty-third Hussars (1946) quoted by Spielberger, Panther, p. 52.

ammunition with extremely high velocity.¹ In another comparison test (76-mm vs. 17-pounder) conducted by a Twelfth Army Group board in August, the sabot ammunition proved to be wildly inaccurate. A British observer claimed it was a bad lot of ammunition but Americans had had similar experience with British sabot ammunition for the 57-mm gun. A plausible explanation of the confusion regarding penetration abilities cropped up in the test just mentioned. The members of the board found that among the three Panthers used for the test the quality of the armor plate varied considerably. Apparently, the results achieved on any test depended upon the particular tank used as a target.² But the firing tests in August were discouraging.

One of the main objectives of the foregoing test was to evaluate the new hyper velocity armor piercing (HVAP) round for the 76-mm gun. The Ordnance Department had increased the penetration of 3-inch and 76-mm ammunition by using a new projectile which consisted of a small, hard tungsten carbide core encased in an aluminum body. The result was lighter than the normal armor piercing projectile and had a higher velocity (3,400 fps versus 2,600 fps.). Even this new ammunition could not penetrate the front slope of the Panther. But HVAP rounds offered a better chance to penetrate other areas of the tank's frontal armor, and the troops wanted all the new ammunition that they could get.

¹Sabot ammunition consists of a small, hard tungsten carbide core encased in an aluminum body that separates from the core after leaving the gun's muzzle. This type of ammunition has become the most important antitank round in US tanks in the 1970's.

²"Final Report of board of officers appointed to determine comparative effectiveness of ammunition of 76-mm gun and 17 pdr gun," HQ, Twelfth Army Group, dtd. 30 August 1944, ETO.

Supply, however, could not keep pace with demand since tungsten carbide was in critically short supply. The resulting ETO rate of supply was only two rounds per month for each gun in the theater.¹

The Ordnance Department, obviously shocked by the tests in July, also took steps to increase the penetrative capability of the 90-mm gun. Their simplest solution was to use more and better powder which increased the muzzle velocity from 2,650 fps to 2,800 fps. But this was not enough to penetrate the Panther. The next step was to modify the heat treatment of the projectile while at the same time providing a cap to reduce wind resistance. Combining the new projectile with the higher velocity finally produced a round, the T33, capable of penetrating the Panther's glacis plate at a range of 1,100 yards. Ordnance engineers also developed a HVAP round for the 90-mm gun. This was the only round that could penetrate the front of a Royal Tiger, albeit at the short range of 100 yards.² But neither type of ammunition

¹Brent, Final Report, ETO, p. 20.

²Items 26318 and 26320, dtd. 8 January 1945, OCM and Armor-Piercing Ammunition for Gun, 90-mm, M3 (Washington, D.C.: Office of the Chief of Ordnance, January 1945). Armor-Piercing Ammunition is one of a series of pocket-size manuals, nicknamed Kangaroos, which the Ordnance Department produced to inform troops in the field about new or developmental equipment. This one is particularly interesting for two reasons. First, the Ordnance Department clearly learned a lesson about evaluating its equipment because the data in the manual is based on tests against German tanks. The results provided illustrations for the manual. Second, the complexity of penetrating armor is vividly demonstrated by the data. The HVAP round (T30) could penetrate thicker armor than the T33 but could not penetrate the Panther's sloped glacis plate.

reached Europe until March 1945.¹ Once again, technological development took time.

By July 1944 there was no way for American technology to react to the need for better guns before the war ended. Recognizing the problem in 1944 only made the failure to identify it in 1943 more distressing. American troops would have to fight with weapons in production or about to enter production, and those would not arrive for months.

Although General Marshall had ordered that M36's be shipped during July, the new tank destroyers did not reach the troops until September-October 1944.² The delay was probably due to two factors, the time required for the sea voyage and the tactical situation at the end of the voyage. Shortly after the First Army tests, the American Army broke out of the confines of Normandy and began an exploitation that soon made tactical problems subordinate to those of logistics. Any combat commander in France during August and September 1944 would doubtlessly have preferred to see 30 tons of gasoline arrive in his area rather than 30 tons of tank destroyer.

The fast exploitation through France showed the M4 at its best. The dependable Shermans rushed toward Germany, destroying retreating German columns whenever they found them. Worries about German tanks faded as Allied armies raced to end the war by Christmas. Those worries also diminished because the M4 held their own in fluid battles during the fall of 1944.

¹Brent, Final Report, ETO, p. 20.

²Brent, Final Report, ETO, App. G.

The largest of these battles were fought in Lorraine. France's 2d Armored Division encountered the 112th Panzer Brigade on 14 September and crushed it. The Germans left thirty-four of their forty-eight Panthers and twenty-six of forty-eight MKIV's rusting at Dompaigne. On 17 September the 113th Panzer Brigade attacked the American 4th Armored Division near Arracourt. Warned by his own patrols Lt. Col. Creighton Abrams, later to be Chief of Staff of the US Army, caught the Germans in a foggy ambush with only a company of Shermans and, when the fog lifted, found a score of factory-new Panthers burning.¹ The M4 could kill Panthers when it could use its maneuverability to get shots at the flanks of the German tanks. Previous tests had shown that even the 75-mm could penetrate the sides of the Panther at ranges of 1,500 yards. It was even possible to kill Panthers in frontal engagements by the risky method of ricocheting shot off the rounded turret front of the Panther and through the thin armor on top of its hull.²

The battle at Arracourt was also a high point for tank destroyers. General Bruce's "ideal" tank destroyer, the M18, proved its worth that day. The 704th Tank Destroyer Battalion with its Hellcats was attached to the 4th Armored Division immediately after its arrival in France in July 1944 and accompanied the division through August and September. Like the 823d

¹H.M. Cole, The Lorraine Campaign (Wash., D.C.: Hist. Div., Department of the Army, 1950), pp. 199, 224, and Lamison.

²Voo Doo: History of the 81st Tank Battalion (81st Tank Battalion Association, 1947), pp. 36-37.

at Mortain, the 704th was soon dispersed among the combat commands (roughly equivalent to regiments) of the divisions.¹ On 17 September 1944, C Company found itself with Combat Command A (CCA) near Arracourt. Two platoons manned an outpost line while the Third Platoon remained at the combat command headquarters.²

Attacking in thick fog, the Germans managed to hit CCA with a Panzer brigade that included forty-two Panthers. Initially, Abrams took the brunt of the attack. The command of CCA ordered the Third Platoon of C/704th to establish an outpost on a hill between CCA headquarters and the tank company. Unaware of the actual situation, the platoon leader, Lieutenant Edwin Leiper, raced off into the fog with his M18's. Approaching the hill, Leiper suddenly spotted the muzzle of a German tank gun some "30 feet away" as the excited lieutenant later remembered. He gave the dispersal signal and his well-trained platoon quickly deployed and opened fire. In minutes five German tanks had been destroyed while only one M18 had been damaged. Remaining on the hill until afternoon, the platoon destroyed ten more tanks while losing two more M18's.³ The platoon's losses, while destroying fifteen German tanks, were in sharp contrast to those of the 823d TD Battalion on 7 August.

The maneuverability of the M18 played a major role in this action and in the remainder of the battle:

It was also generally agreed that the tank destroyer missions at ARRACOURT could not have been as well performed by heavy tanks...in as much as

¹Employment, p. 65 and Report No. 1095, "M-18 Hellcat Tank Destroyer," dtd. 9 February 1945, Bruce.

²Employment, pp. 66-70.

³Employment, pp. 71-76.

the tank destroyers were able to utilize speed and maneuverability over rough and muddy terrain over which heavy tanks would have been unable to move.¹

While successful actions such as the one at Arracourt did nothing to build the reputation of German tanks they are not the main reason that the issue would wait until 1945 for public exposure.

A major reason for the lack of convincing proof of German tank superiority was the scarcity of the newer German types until late in the War. Table 3 shows that the Mk IV remained the most important German tank until well into 1944, and, although this table does not break down the numbers of Mk VI's into the older Tiger I and new Tiger II, the table shows clearly that there were few Tigers available to meet the Normandy invasion.²

TABLE 3
GERMAN TANK STRENGTH IN ITALY AND IN WESTERN EUROPE

	Italy, Feb. 44	West, Feb. 44	West, June 44
Mk III	106	99	39
Mk IV	171	587	748
Mk V	0	290	663
Mk VI	8	63	102

Table 4, although it does not divide German tank strength between East and West, reaffirms that the Mk IV formed the backbone of German tank strength until late in the war. The table is

¹Employment, pp. 79.

²Tables 3 and 4 compiled from information in General Burkhardt Mueller-Hillebrand's, Tank Losses, Project #47, Historical Division, European Command, 10 November 1950.

also interesting because it shows that the Tiger II was very scarce indeed.¹ The decline in numbers of the Tiger I reflects the fact that it went out of production in August 1944.

TABLE 4
TOTAL GERMAN ARMY (EAST AND WEST)
TANK STRENGTH READY FOR ACTION

	Sept. 43	Jan. 44	June 44	Dec. 44
Mk IV	1203	1492	2138	1630
Mk V	601	1084	1898	1966
Mk VIE (Tiger I)	284	395	615	243
Mk VIB (Tiger II)	0	0	31	166

These tables show that heavier tanks formed only about half of total German tank strength. The Sherman and available tank destroyers were fully capable of dealing with the Mk IV, the most numerous tank. This fact goes far to explain the overall success of the United States armored divisions in defeating German armor. The actual number of superior German tanks in action on the front never lived up to the number reported by American soldiers. In the heat of battle there was a tendency to call every German tank a Tiger and every antitank gun an 88 (although 75-mm antitank guns far outnumbered the 88's). At combat ranges (500-1500 yards) tanks, particularly German ones, look much alike. The numbers of

¹According to "Henschel & Sohn, Kassel, Germany," The United States Strategic Bombing Survey, (Washington, January 1947), p. 2, the Germans lost 77 percent of their planned production of Tiger II's due to bombing raids on the Henschel plant, sole producer of that tank.

the King Tiger (Mk VIB) are particularly interesting since Newsweek and Hanson Baldwin were to use these tanks as a basis of comparison with the Sherman (see page 2). Their comments implied that the United States tankers were mainly encountering Royal Tigers, but these tables suggest that this was obviously impossible.

An important reason that American soldiers failed to recognize German tanks was that they saw so few of them. Encounters with German tanks were not a daily occurrence. Prying German infantry and guns from well-prepared positions was the more typical problem. Even tank destroyers were engaged in this type of mission more often than fighting enemy armor. From August 1944 to February 1945 the First Army's 3-inch guns, found only in tank destroyer units, fired 337,367 rounds of high explosive shell versus only 29,210 rounds of armor piercing ammunition.¹ But fighting German tanks became more difficult as the Allies approached Germany.

Europe's wet winter and more difficult terrain near the German border began to hamper operations. The first real setback for American tanks came in November at Puffendorf, Germany. Mud robbed the 2d Armored Division's Shermans of their ability to maneuver for shots at the vulnerable flanks of German tanks. Panthers and Royal Tigers stopped two battalions of the 2d Armored and dealt them heavy losses. Only the fortuitous arrival of some M36's salvaged the situation. The paucity of American experience in tank versus tank combat is best illustrated by this action.

¹First United States Army, Report of Operations, Annex 9, p. 28.

This "biggest tank battle in 2d Armored Division experience" involved only twenty-five German tanks.¹

Lack of experience in fighting German tanks did not stop Americans from judging their tank destroyers. Towed guns would continue to lose popularity. The mobile and easily manhandled, 900 pound 37-mm gun which had convinced McNair in 1940 that towed guns were maneuverable enough to fight tanks, had grown into the unmanageable 5,000 pound 3-inch gun. Tank destroyers, like tanks, had to find the flanks of Panthers and Tigers in order to kill them since neither the 3-inch or 76-mm guns could penetrate the front of those tanks at practical ranges. Self-propelled guns were able to do this far better than towed ones. Besides their superior ability to destroy tanks, self-propelled tank destroyers proved to be generally more useful than towed weapons. One tank destroyer officer commented that:

...the appearance and knowledge that self-propelled tank destroyers were at hand was a major reason that the infantry attained success and victory....The towed guns can be just as brave and thoroughly trained but they never give much "oomph" to the fighting dough-boy when the "chips are really down."²

Senior commanders agreed and requested more self-propelled units in September. After coordinating with the War Department, ETO decided to begin converting towed units in the theater to self-propelled equipment. In November the War Department found that ETO wanted forty self-propelled battalions and twelve towed. All

¹Mayo, Battlefront, pp. 325-326.

²GB 60, p. 18.



Figure 17. A crew struggles to emplace its 3-inch gun, Germany, 1945. Source: U.S. Army Photo.



Figure 18. An M18 in Germany, 1945. Source: U.S. Army Photo.

towed units were to receive 90-mm guns.¹

Although the other arms generally held the tank destroyers in high regard, there were exceptions. Training and morale varied among tank destroyer battalions. Probably more important, the status of tank destroyers as an attached unit often meant that companies and platoons suddenly found themselves joining an infantry or armored unit just prior to combat. Unfamiliarity bred mutual mistrust, sometimes with unfortunate consequences. One man who commanded an infantry regiment commented about his attached tank destroyers:

Company C, /number omitted/ TD Battalion, was probably the most dependable attached unit which I commanded. It uniformly failed in all its assigned tasks! It possessed no fighting spirit whatsoever, and was happiest when well to the rear, or tagging along behind the tanks. It was useful on road-blocks and defensive situations, where they /sic/ served to deter the enemy if he should see them.²

Fortunately, those comments were not typical.

The effort to convert towed battalions to self-propelled guns was still under way in December 1944. In general, units with M18's were new units equipped in the United States. The M36's replaced either towed guns or M10's. Excess M10's were given to towed units as the vehicles became available. Some units were in

¹Letter from Maj. Gen. J.E. Hull, Asst. C/S to HQ, ETO, dtd. 16 November 1944, and Memo from Hull to G-4, dtd. 27 November 1944 with Memo for record, Records of the Operations and Plans Division (OPD), RG 165, file no. 472.1, National Archives.

²Letter from HQ, AGF to CG's Replacement and School Cmd., Armored Center, and TD Center, undated (but sometime after August 1944), Folder 189, AGF Obs. The letter contains extracts of a report by Col. Clyde E. Steele who commanded a regiment of the 36th Inf. Div. in France.

the midst of conversion when the greatest challenge to tank destroyers began.

After massing nearly 1,500 tanks and self-propelled guns, Hitler struck through the Ardennes in December 1944. For the first time the American troops faced the task of stopping massed German armor. There was no opportunity to mass tank destroyers as advocated by FM 18-5. Unwarned by "Ultra" the American Army was surprised by the Germans.¹ The attack found American units spread thinly among the forest and ridges of the Ardennes with tank destroyers dispersed among them. Bad weather, which hampered Allied airpower, favored the Germans. The broken terrain did not compensate for the limited range of American tank guns as well as the bocage in Normandy had done.

Tank destroyers played a crucial role throughout the battle, since the German formations involved in the attack included many armored vehicles. But even after the Allies realized the scale of the attack, there was no attempt to group tank destroyers. The Battle of the Bulge was a confused, fluid action that found American command and control fragmented. Combat commanders, from army commanders to squad leaders, fought their own, local battles with whatever assets they found at hand. But the Army's history of the battle points out, "The mobile, tactically agile, self-propelled, armored field artillery and tank destroyers are clearly traceable in the Ardennes fighting as over and over again influencing the course of battle."²

¹Winterbotham, The Ultra Secret, p. 177.

²Hugh M. Cole, The Ardennes: Battle of the Bulge (Washington, D.C.: OCMH, 1965), p. 653.

Combat in the Ardennes completely discredited the towed guns of tank destroyer units. The towed guns' lack of mobility made them less effective than self-propelled guns and resulted in greater losses. Towed guns could not maneuver to obtain the flank shots necessary to kill heavy German tanks. They could not advance to support a counterattack and were almost inevitably lost when a retreat was necessary. For example, of 119 tank destroyers lost by the First Army in December, 86 were towed.¹ The veteran of Mortain, the 823d TD Battalion, contributed to those losses.

Still attached to the 30th Infantry Division of the First Army, the 823d was one of those units that was in the middle of conversion to self-propelled guns when the Germans attacked. The battalion had begun to receive M10's in early December and by mid-month had four per company. Hastily committed to battle on 17 December, the battalion's companies generally tried to use towed guns in forward positions and retain the M10's as a mobile reserve. In a typical action the 823d TD Battalion recorded that "Upon the withdrawal of friendly Infantry, TD guns were one by one flanked by enemy tanks and personnel driven from the guns by small arms and machine gun fire...." Nine guns were lost in the foregoing incident.²

On 29 December General Holly wrote to the War Department that, "100% self-propelled T.D.'s now desired. Towed people are

¹First United States Army, Report of Operations, Annex 4, p. 22.

²823 AAR, 4 December, 10 December, 11 December, 17 December, and 19 December 1944.

quiet these days."¹ As a result of losses in the Ardennes, ETO asked to convert all towed battalions to self-propelled equipment.² The War Department approved the theater's request on 11 January 1945.³ Thus, towed guns, demanded as a result of early combat experience, were abandoned as a result of combat experience.

Combat commanders now viewed the self-propelled tank destroyers with esteem. The Third Army was so enthusiastic about the M18's mobility that they referred to the vehicle as "...the finest piece of tracked equipment in the U.S. Army."⁴ However, views concerning tank destroyers were not unanimous. While the Third Army preferred mobility, the First Army desired heavier armor instead of speed.⁵

The available M36's proved to be a blessing during the Battle of the Bulge. Often the M36 was the only weapon capable of dealing effectively with the heavy German tanks. For example, one narrative of the fighting near the Elsenborn Ridge related the following incident:

Powers / Lieutenant Powers of the 740th Tank Battalion slowly pushed on, having no idea what lay ahead. A second big tank loomed up. Before the German could fire, Powers sent a round into the Tiger's front slope plate. The

¹Letter from Holly to Brig. Gen. W.A. Borden, New Developments Division, War Dept., dtd. 29 December 1944, G-4 (473), RG 165, National Archives.

²GB 60, p. 2.

³Routing Slip, dtd. 3 March 1945, G-4 (473), contains a reference to the message.

⁴Third Army After Action Report, Part 24, "Tank Destroyer," Chapter 13, 1 August 1944 to 9 May 1945, Command and General Staff College Library No. N-11480-B.

⁵Letter from HQ, 12th Army Group to CG, ETO, dtd. 9 November 1944, AGF (473).

shell bounced off harmlessly.

Powers' gun jammed. Since the radios were useless, he hand-signalized the tank destroyer to move in. The Tiger, jarred by Powers' first shot, fired two wild rounds. Then the American tank destroyer's big 90-mm roared. The Tiger flamed.

But there were not enough M36's. By 20 December there were only 236 of them in the hands of troops.²

American tanks had to bear a major share of the defense. Most Shermans still had the 75-mm gun. Losses soared as the tankers saw their shells bounce off thick German armor while their Shermans went up in flames. Table 5 shows these losses.³

TABLE 5
MONTHLY LOSSES OF ETO, 1944-45

	20 Oct.-20 Nov.	20 Nov.-20 Dec.	20 Dec.-20 Jan.
M4 (75 & 76)	257	495	585
M4 (105)	11	28	29
M7 (105 SP howitzer)	3	105	0
M10	45	62	69
M18	7	44	27
M36	5	21	26

The cry for weapons capable of destroying Panthers and Tigers went out "prayerfully or profanely--wherever the enemy Panzer Divisions appeared out of the Ardennes hills and forests."⁴ The troops were mad. They told the correspondents. The lack of American firepower quickly spread over the pages of United States newspapers.

¹John Toland, Battle: The Story of the Bulge (New York: Random House, 1959), p. 135.

²Brent, Final Report, ETO, App. G.

³Table compiled from Brent, Final Report, ETO, Appendix G.

⁴Cole, The Ardennes, p. 125.

CHAPTER VIII
DEVELOPMENT: 1944

As American soldiers discovered the quality of their tanks in battle, quarrels over development continued with ever-increasing acerbity in the United States. The T25, which had finally been approved for production during the last weeks of 1943, became the main issue of controversy.

Development of the forty T25's and ten T26's ordered in May 1943 never faltered during 1943 even though ASF questioned the approval of Devers' request for mass production. General Eisenhower's concurrence with Devers' request in January 1944 ended ASF's opposition. But technology would not be rushed. By 10 December 1943, drafting work was still only 95 percent complete on the T25 and an even slower 85 percent on the T26.¹ A pilot model of the T25 was completed in January 1945, and the T26 followed in February (production of the original order of forty T25's and ten T26's was completed in May 1944).²

Development of the T25 and T26 was not opposed by AGF or the Armored Force in 1944 despite postwar claims of the Ordnance Department's spokesmen to the contrary. Only twelve days after

¹T20 Chron., 10 December 1943.

²Hunnicut, Pershing, p. 51.

Campbell, the Chief of Ordnance, complained on 19 January that production of some other type of armored vehicle would have to be cut to provide Ford engines for the T26, ASF approved reducing production of the M7 105-mm motor howitzer carriage, the Army's only self-propelled artillery weapon in mass production, by 341 units.¹ ASF had again urged the Ordnance Department on 8 January "to expedite production" of the T26.² AGF cooperated with development on 16 March by sending members of the Armored Board to Aberdeen (the Board did not usually participate in any tests until tanks arrived at Fort Knox) to "shorten the time of tests."³

Despite unusual cooperation in an effort to complete tests on the T26 and thus get the tank into production, the first time estimates were not encouraging. The War Department had asked for tentative production schedules. The Ordnance Department's optimistic January response was quickly revised in February. The tentative schedules are listed below:⁴

TABLE 6
TENTATIVE PRODUCTION OF T26

14 January 1944		19 February 1944	
July	15	Oct. 1944	6
Aug.	35	Nov.	25
Sept.	60	Jan. 1945	40
Oct.	60	Feb.	50
Nov.	60	Mar.	50
Dec.	20	Apr.	29

¹Letter from HQ, ASF to Chief of Ordnance, dtd. 31 January 1944, 1st Ind. to Letter from Chief of Ordnance to HQ, ASF, dtd. 19 January 1944, ASF.

²Memo from Clay to Chief of Ordnance, dtd. 8 January 1944, ASF.

³T20 Chron., 16 March 1944.

⁴Memo from HQ, ASF to ACS, dtd. 21 February 1944, ASF.

After the war the historians of the Ordnance Department would claim the T26's could have been available for D-Day had production been approved in September 1943 instead of three months later in December. Even if one could ignore the state of development of the T26 in 1943 and accept the optimistic view that an early order would have meant a corresponding advance in production, T26's could never have been available by D-Day. Subtracting three months from the Ordnance Department's own estimate in February 1944 results in the production of six tanks in July, hardly in time for the invasion. And even the February estimate would prove to be optimistic.

The realization that there would be a long delay before T26's could reach Europe started a new development program. Heavy armor was one of the most important characteristics of the T26. ETO's request for the vehicle indicated the soldiers in the field wanted a heavily armored tank quickly. So AGF proposed to satisfy the need by adapting the Sherman tank.¹ The AGF proposal was to increase the Sherman's ~~armor~~ by welding an extra one and one half inches of armor to the hull for a total of four inches. By the same means, the armor of the T23 turret could be increased to six

¹Memorandum from Col. Crawford F. Sams to the Assistant Chief of Staff, G-4 / War Department 7, "Subject: Conference on Heavily Armored Tank, dtd. 29 February 1944, AGF (470.8). General Dean of AGF chaired the conference which was also attended by representatives of ASF, the Ordnance Department, and the War Department. The memorandum reveals that the decision to increase the armor of the Sherman was more rational than the one to increase the armor of the T25. AGF wanted armor thick enough to resist Germany's 88-mm Flak 41, but the eleven inches required was impractical. The conferees also consulted an operational analysis of hits made by German antitank guns on a Sherman and a British Churchill tank. But it is not clear how the analysis affected their decision.

inches. In March 1944 ETO responded favorably to the War Department's query about this, and the latter ordered production the same month.¹ By November 1944 the new tank, M4A3E2, dubbed "Jumbo" by the troops, was proving its ability to shrug off the shells from German antitank guns.² General Patton was so impressed by the vehicles that he tried to insure that one led every column attacking toward Bastogne during the Battle of the Bulge.³ AGF's account of this program lauds the Ordnance Department for doing a "magnificent job." But it pointedly notes that "the project was handled by the Ordnance Department Production and Engineering Divisions and the Technical Division [Barnes's] was little concerned."⁴ The speedy introduction of the Jumbo and its success in combat were further proof of the Sherman's adaptability.

The long delays of the tentative production schedule for the T26 had not discouraged Campbell, who remained enthusiastic about the tank and called Barnes on 29 March to ask how the tests were going. Barnes replied that, "From tests up to the present time nothing major has come up and it would be safe to order them in quantity...."⁵ Encouraged by Barnes's response, Campbell finally made a direct proposal for large scale production. Writing to Brehon Somervell, Commander of ASF, on 31 March, Campbell

¹McCaskey, Study No. 34, pp. 43-44.

²Cole, Lorraine, p. 363.

³Cole, Ardennes, pp. 525 and 652.

⁴McCaskey, Study No. 34, p. 44.

⁵T20 Chron., 29 March 1944.

recommended that orders be placed for at least 2,000 or preferably 4,000 tanks in order to get them into production on a quantity basis during 1945. General Campbell assured Somervell that it was not important to decide the proportion of T25 or T26 tanks immediately, since "...from a tooling standpoint both tanks were very similar...." Detailed changes in the design made necessary by service tests, Campbell assured, could easily be made in the six or eight months before production started.¹ General Somervell's representative, Lucius Clay, quickly passed the buck to AGF, commenting on 2 April that it did not seem advisable to begin retooling facilities unless a demand was established, but he left the decision to the officials of AGF if they were "...prepared now to state that the model will be required in large numbers."²

AGF acted quickly to assure the success of Campbell's proposal. Apparently, AGF had queried the Armored Board about the desirability of mass production. Col. Frank R. Williams of the Board replied on 6 April recommending the following numbers of T25's with corresponding armament:

640	105-mm Howitzer
4,560	75-mm gun
2,400	76-mm gun

Williams did not want the 90-mm gun and its larger turret unless an actual need was established.³

¹Memo from Campbell to CG, ASF, "Subject: Medium Tank T25E1 and Heavy Tank T26E1," dtd. 31 March 1944 (hereafter cited as "Tank"), G-4 (470.8).

²Letter from Clay to CG, AGF, dtd. 2 April 1944, 1st Ind. to "Tank," ASF.

³Letter from Col. Frank R. Williams, President, Armored Board, to CG, AGF, "Subject: Tank Program for 1945", dtd. 2 April 1944 (hereafter cited as Williams, "Tank Program"), ETO.

After receiving the recommendations from the Armored Board, AGF quickly replied to ASF on 12 April that, "This Headquarters concurs with the recommendations of the Chief of Ordnance..." and reinforced the request by transmitting the same requirement directly to the War Department's G-4. AGF recommended the numbers and armament of tanks that it had received from Williams. However, AGF qualified the recommendation by asking that the commander of ETO be questioned about desired armament and noted that AGF recommendations would be changed if necessary as a result of the theater's answers. In addition, AGF emphasized that its recommendations were not a request for production of the tanks in their present form, because of stowage and mechanical difficulties.¹

The Armored Board, which was also represented at the Aberdeen tests in March, had a far different impression of the results than the glowing assurances of General Barnes. The Armored Command identified several major deficiencies. Barnes knew of at least two of these but, apparently, glossed over them when he assured Campbell that the tank was ready for quantity production. Suspension components broke during operation. The coupling between the engine and transmission failed on several occasions. Ordnance engineers had forgotten that their torque-matic transmission did not allow the engine to be used for braking, and this caused too much wear on the tank's brakes. Drive sprockets also wore excessively.² In addition to all those defects,

¹Letter from HQ, AGF to CG, ASF, dtd. 12 April 1944, 2d Ind. to "Tank," G-4 (470.8).

²Williams, "Tank Program" and T20 Chron., 10 March and 15 March 1944.

another major problem clearly illustrated the Ordnance engineers' failure to ask advice from tankers.

Stowage for ammunition was manifestly unsatisfactory. Besides the fact that only forty-two rounds could be carried, the system for stowage, carried forward from the T23, made the tank totally unsuitable for combat. Ammunition was stowed in metal satchels that each held two rounds. As the shells were used the satchels had to be removed to expose more ammunition. These satchels soon filled the turret but could not be discarded since they were needed when the tank was resupplied with ammunition.¹ Obvious defects such as this should have been identified at the mock-up stage, yet it was an inescapable fact that the problem persisted all the way to the prototypes. Not surprisingly the Armored Board, reflecting a genuine concern for the users' point of view, objected vehemently to this feature. It is difficult to understand how this obviously defective ammunition stowage system remained unnoticed all the way up to the prototypes unless the tankers' point of view had been ignored during design. This flaw underlines the Ordnance Department's repeated failure to solicit the active and informed participation of the user early in the development process. The AGF request illustrated still other disagreements between AGF and Ordnance.

Officers of AGF preferred the T25 over the T26. The men at the War College felt that the T26 was underpowered since it had to use the same engine as the T25 but was about eight tons

¹Williams, "Tank Program."

heavier. German engineers had been able to move toward bigger guns and heavier armor in the Panther while retaining satisfactory mobility because they had the Maybach V-12 with 690 horsepower available for the 45-ton tank. American designers were forced to rely on the Ford V-8 of only 450 horsepower since that engine was the best available during World War II. The Ford engine was adequate for the 35-ton Sherman and T25. The extra weight on the T26 badly affected its mobility. During the Korean War mountainous terrain would clearly reveal the T26's lack of power. Old Shermans had to fill the gap as the primary American tank during that police action's early stages.¹

AGF's desire for 75-mm and 76-mm guns was largely due to its continued opposition to large guns in tanks. The Requirements Section was also worried that ammunition for the 90-mm gun would be too large for the crew to handle efficiently.² Indeed, the size of 90-mm rounds did prove to be a problem. Interviews during the immediate postwar period revealed that tank crewmen generally believed that the 90-mm round was "too large."³ The tankers apparently liked the 90-mm gun's ability to penetrate armor but did not necessarily like the gun itself. Tank crews, and AGF, wanted to improve the 76-mm gun so that its ability to penetrate armor would equal the 90-mm gun's but opposed going to

¹T.R. Fehrenbach, This Kind of War (New York: Pocket Books, 1963), p. 719.

²Dean, Statement.

³The General Board, United States Forces, European Theater, "Tank Gunnery", Study No. 53, dtd. 1945, p. 27. Copy obtained from the Office of the Chief of Military History, Department of the Army, Washington, D.C.

larger guns to get better penetration.¹

The request for T25's with 76-mm guns also reveals the extent of AGF opposition to the electric drive. The T25 with a 76-mm gun was essentially a T23 without the electric drive. Using the same hull and engine as the T23, the T25 had a larger turret only in order to accommodate the 90-mm gun. Satisfying AGF's request merely involved placing T23 turrets into T25 hulls. If Barnes had been willing to substitute the torquematic transmission for the electric drive in the T23, as AGF had suggested in July 1943, it probably would have accepted the tank. But the Ordnance Department refused to abandon the electric drive, and this made the T23 unacceptable.

Despite AGF criticism of the armament of the T25, its request was a major victory for the Ordnance Department. General McNair had finally agreed to a large scale production for the T20 series. General Campbell had requested only 2,000 to 4,000 of either the T25 or T26. The response from AGF for 7,600 of the tanks must have exceeded his wildest expectations. Since the AGF request had noted that production of M4's should cease as soon as production of T25's could meet operational requirements, McNair had finally found a tank good enough to replace the Sherman.² But his views on types and armament met opposition.

Forwarding the AGF request to Maxwell, the War Department's G-4, on 15 April, Clay asked him to solve the problems raised by

¹Dean, Statement.

²Memo from HQ, AGF to Chief of Staff, USA, dtd. 12 April 1944, G-4 (470.8).

AGF. He doubted the desirability of producing the T25 with 75-mm and 76-mm guns because "The principal superiority of the medium tank T25E1 over the medium tank M4 lies in the increased firepower of the 90-mm gun." Clay also requested Maxwell to decide whether the T25 should replace the M4 and on what basis the T26 should be produced.¹

General Maxwell quickly settled both issues. He did not believe that the T25, with or without the 90-mm gun, was convincingly superior to the Sherman. So the T25 would not replace the M4. Influencing Maxwell's decision was the fact that no theater had ever asked for the T25; requests from overseas had only mentioned the T23 (with its electric drive which had not yet satisfied AGF) or the T26. On 17 April Maxwell met Campbell's minimum demand by ordering Somervell to produce 1,800 T26's armed with the 90-mm gun and 200 more with the 105-mm howitzer. Maxwell discussed his decision with Maj. Gen. Albert W. Waldron, the new Chief of the Requirements Section of AGF, before issuing the directive. Waldron acquiesced pending McNair's approval. McNair reserved final concurrence until he heard from ETO, and Marshall confirmed the decision.²

The theater answered the query on 18 May (Chapter VI). The European Theater's firm requirement for 90-mm guns and 105-mm howitzers finally settled the dispute over armament. Shermans and T26's with the 105-mm howitzer would meet ETO's requirement for that weapon while the T26 would satisfy requirements for 90-mm

¹Letter from HQ, ASF to ACS, G-4, dtd. 15 April 1944, 3d Ind. to "Tank", G-4 (470.8).

²Memo from Maxwell to CG, ASF, dtd. 17 April 1944, G-4 (470.8).

guns. General McNair still thought that the decision in favor of 90-mm guns was a mistake, but, since the overseas commanders had made themselves perfectly clear on the issue, it was now time to carry out orders.¹ Thus, McNair's long opposition to the T26 abruptly ended.

The decision in favor of heavier guns illustrates a key feature of the Army's decision-making process for development. There was no rigorous, systematic method for resolving differing viewpoints about new equipment. Even important subjects such as tank armament did not receive a detailed analysis of the technical or tactical issues involved. Rather, Marshall, or usually his staff, took varying opinions into account and then made a decision. The views of overseas commanders obviously carried the most weight. But Marshall neither asked for or received a detailed justification from ETO about its preferences. In his defense, one should note that the controversy over tank guns must have seemed minor in comparison to problems such as global strategy. Furthermore, Marshall had to have a broad perspective which probably took British desires into account.

The British had maintained a close interest in the T26 during the first months of 1944 and asked on 14 March for 500 of the tanks. The War Department responded that approval would be withheld until field tests were complete.² But Clay apparently

¹Dean, Statement.

²Letter from Col. J.W. Boone, Deputy Director, International Division, to Brigadier L.R.S. Dawes, dtd. 23 March 1944, G-4 (470.8).

saw no reason for further delay after he had ordered 2,000 tanks without service tests. On 24 April he directed Campbell to produce 500 additional T26 tanks, raising the grand total to 2,760 of which only 115 were to be produced during 1944.¹

Although the War Department had settled on the T26, the tankers at Fort Knox were still unhappy. The Armored Command realized that there would still be a long delay before the T26 could be of help on the battlefield. It proposed to AGF on 17 April that Britain's Fireflies could fill the gap until T26's were in the hands of the troops. Attached ballistic data on the Armored Board letter to AGF showed the 17-pounder's superiority over the 90-mm in terms of armor penetration. Although AGF only wanted to know if the data was correct, Barnes replied on 16 May with a long defense of the 90-mm. Barnes also claimed that the 17-pounder would overload the M4, though the British had never complained about any suspension problems.² Barnes's most convincing argument was that it would take at least eighteen months to produce ammunition for the 17-pounder in the United States. But the 17-pounder was never mounted in American tanks in the United States. The tankers were obviously worried by delays in getting better tank guns overseas. The assertion of some of them at Fort Knox in May 1944 that the United States should get a Panther and

¹Memo from Clay to ACS, G-4, dtd. 24 April 1944, ASF.

²"For Record Only," Letter from HQ, ASF to Chief of Ordnance, Tech. Div., dtd. 9 May 1944, 2d Ind. to Letter from HQ, Armored Center to AGF, dtd. 17 April 1944; and Letter from Barnes to CG, ASF, dtd. 16 May 1944, 3d Ind. to Armored Center letter, ASF.

copy it was a cry of desperation.¹

While the production decisions were being made, testing of the T25 and T26 continued. It is significant, considering the importance of successful service tests before tanks could be standardized, that the Armored Board did not have a T25 or T26 by 29 April, although the Ordnance Department then had several of them.² The faults observed at Aberdeen by Armored Board members were not imaginary. General Barnes admitted the most important of them to ASF on 1 May.³ By 10 May Ordnance engineers realized that the engine/transmission coupling on both tanks would have to be redesigned but were still investigating the problem with the brakes.⁴ After the Armored Board began testing the T26 at Fort Knox, the tanker's complaints were reaffirmed. On 20 May the Armored Board emphasized that the design should not be frozen for production in its present state.⁵

As testing continued the planned production of the T26 continued to rise. Apparently to meet ETO's demands for the 105-mm howitzer, and British desires for the T26, Maxwell more than

¹Memo from Major K.G. Peters to Assistant Chief of Staff, G-4, "Subject: Travel Report," dtd. 10 May 1944, G-4 (470.8).

²Letter from HQ, ASF to Chief of Ordnance, dtd. 29 April 1944, ASF.

³Memo from Barnes to CG, ASF, dtd. 1 May 1944, ASF.

⁴T20 Chron., 10 May 1944.

⁵"For Record Only," Letter from HQ, ASF to Chief of Ordnance, Tech. Div., dtd. 2 June 1944, 2d Ind. to Letter from Pres., Armd. Bd. to CG, AGF dtd. 20 May 1944, ASF.

doubled the overall figure on 10 June.¹

For U.S.

T26/90----2,000
T26/105---2,788
4,788

For Britain

T26/90----750
T26/105---400
1,150

Grand Total: 5,938

The T26 would be the most important tank, numerically, produced for the Army during 1945. Another part of Maxwell's order was an additional victory for the Ordnance Department.

Maxwell waived the weight and height restrictions of AR 850-15 for the T26.² The Corps of Engineers, responsible for providing tactical bridges for the Army, was the loser. Engineers had labored mightily to provide floating bridges to the Armored Division capable of handling loads up to 35 tons, enough for Shermans. In February 1942 the Ordnance Department assured the engineers that procurement of 35-40 ton tanks was so remote a possibility that it did not warrant procurement or planning of new bridging equipment.³ Nonconcurring with the Ordnance Committee item that approved the T25 and T26, the Engineers pointed out that, "...there is no standard piece of bridging over which the vehicle (T26) may pass." Further, even when the width of the T26 was reduced for rail shipment by removal of its tracks, there were only certain rail lines with sufficient width clearance.⁴ In answering Colby's postwar comment that, "Hitler's tanks violated

¹Disposition Form, signed by Maxwell, dtd. 10 June 1944; and memo from Clay to ACS, G-4, dtd. 9 June 1944, ASF.

²Ibid.

³Coll, Troops, p. 483.

⁴Item 20342, dtd. 24 April 1943, OCM.

AR 850-15," one can belabor the obvious by pointing out that German tanks did not have to cross American bridges.¹

Not surprisingly, the T26 was a problem when it finally arrived in Europe. But the Chief of Engineers of SHAEF found that the ponton bridge could be crossed if it were fully reinforced, that the treadway bridge could be used in emergencies, and that a modified Bailey bridge could be negotiated. But the T26 was too wide for movement by railroad.² It was necessary to ship special transporters with the tanks. In one of its first actions in combat, the T26 revealed its limitations. Although T26's were present when Americans forced the Rhine River at Remagen, they were too wide to follow Shermans across the Ludendorff bridge.³

Soon after this victory over the Engineers, the Ordnance Department finally got its heavy tank, at least semantically. The Ordnance Committee renamed the T26 a heavy tank on 29 June.⁴ Long believing in heavy tanks, the Ordnance Department had actually completed such a tank in December 1941. This tank was standardized in 1942 as the M6. President Roosevelt's expansive order that the United States would produce 500 heavy tanks in 1942 and 5,000 more in 1943 probably forced standardization since the

¹Col. Joseph M. Colby, "From Designer to Fighter," Armor, January-February 1950, p. 15.

²Letter from Brig. Gen. B.C. Dunn, Chief Engineer, SHAEF, to Chief Engineers of 21 Army Group, 12 Army Group and 6 Army Group, dtd. 2 February 1945, ETO.

³Hunnicut, Pershing, p. 12.

⁴OCM item 24277, dtd. 29 June 1944, copy in T20 Hist.

M6 was the only contender.¹

After reaching the Armored Board the M6 proved to be a technological failure. Armored officers found the tank to be extremely unreliable. The Armored Board was not even able to conduct a satisfactory test because the tank broke down so often. Among other things, the transmission continually failed, suspension springs broke easily, bogie wheels wore out rapidly, and mud compacted in the suspension sufficiently to immobilize the tank.²

In spite of all this, the Ordnance Department continuously pressed for mass production of the M6 and shipment to combat zones. As late as August 1944 the Ordnance Department was still trying to send M6's overseas. By this time they proposed to equip a limited number with a 105-mm antiaircraft gun. Based on advice from Fort Knox, Eisenhower turned down the M6 in spite of the interest that he had already shown in securing heavy tank guns. The Armored Board had expressed doubt that the M6 would be of any use in combat since it was too heavy to transport and could not be relied upon to arrive at the battlefield under its own power.³ The M6 might have been a satisfactory fort, but as a tank it was a failure.

Its successor, the T26, was already causing some difficulty at Fort Knox. On 30 June 1944, the Armored Board complained of delays in getting spare parts for the tanks being tested there.

¹Chamberlain, Tanks, p. 155.

²Memo from CG, AGF to CG, ASF, dtd. 3 January 1945, AGF (470.8).

³Letter from Pres., Armd. Bd. to CG, AGF, 12 August 1944, ETO.



Figure 19. The T26E3, standardized as the M26 "Pershing."
Source: U.S. Army Photo.

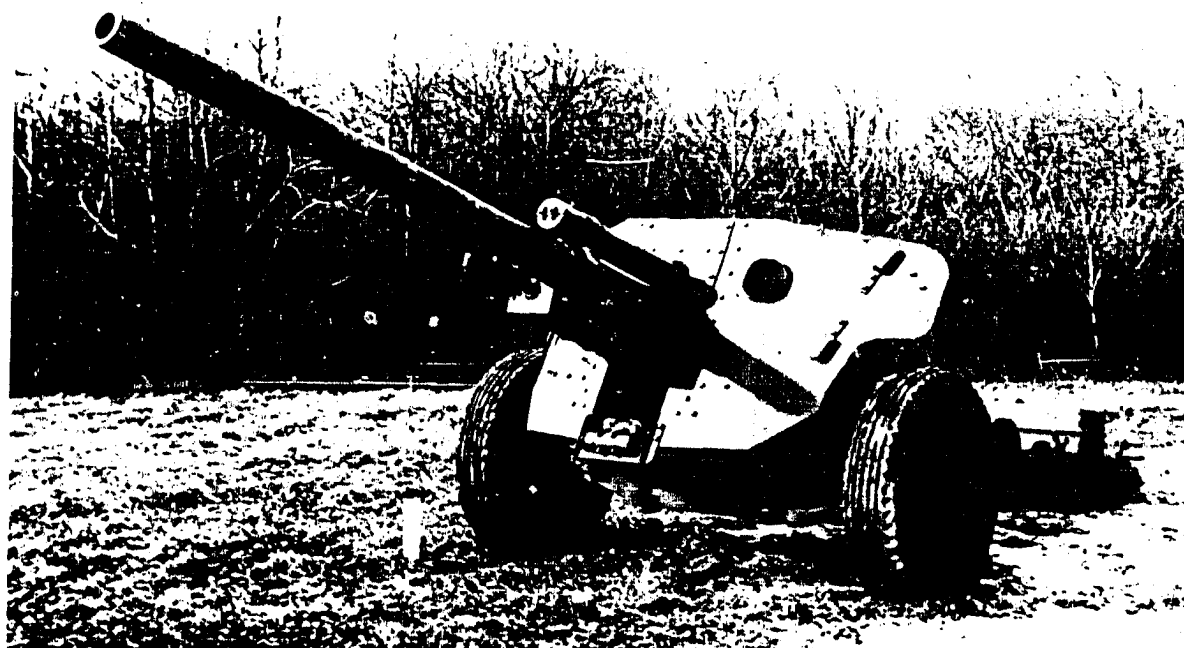


Figure 20. The T5E2 90-mm gun carriage. Source: T5 Hist.

One of the T26's had been inoperable for a week, and lack of parts was to be a problem for the Armored Board throughout the summer and fall. In September the Board complained that one T26 had been inoperable for 72 out of 109 available days.¹ Although AGF protested about all the delays and ASF admonished the Ordnance Department, the problem was not solved. It is surprising, considering the importance of the service tests to the future of the tank, that the Ordnance Department did not see that they were completed as rapidly as possible. The involvement of major headquarters such as ASF and AGF in such a petty matter as spare parts for an individual tank was perhaps more revealing, as the relationship between Barnes and AGF grew ever more caustic.

Development of the 90-mm towed gun generated almost as much trouble. The Link-Belt Company had produced a prototype T5 by January 1944 and had said they could begin production in June. But tests by the Ordnance Department revealed some serious defects. New trails and a change in the position of the axle forced a major redesign and a change in designation to T5E1. By May, Link-Belt had delivered another gun to Aberdeen. Discovery of thirty-eight more defects, mostly associated with unsatisfactory recoil characteristics, caused further redesign.²

Meanwhile, pressure was building to get the gun into production. General McNair witnessed a demonstration of the T5E1 on

¹Letter from HQ, AGF to CG, ASF, dtd. 9 July 1944, and Letter from HQ, ASF to Chief of Ordnance, dtd. 18 October 1944, ASF.

²T-5 Chron., 19 February, 4 April, and 17 May 1944; and letter from Ord. Research Center to ASF, Ord. Off., dtd. 10 May 1944, T-5 Hist.

2 May and was apparently impressed.¹ A request for completion of the design and production of 600 guns "...at the earliest possible date" followed his visit.²

But Ordnance Department officials had ignored AGF's desires. In June of 1944 they finally instituted a design program to adapt the T5 for a muzzle brake which had been requested by AGF in November 1943.³ A dispute arose after McNair witnessed a later firing test that compared the gun with and without a muzzle brake. Ordnance officers apparently believed that General McNair had then dropped the requirement for a muzzle brake. AGF clarified this on 14 July 1944. An interoffice comment that "The Ord/Dept alleges...the requirement...was withdrawn..." indicated the acrimonious nature of relations between AGF and Ordnance.⁴ In defense of the Ordnance Department, the addition of a muzzle brake to the 90-mm gun tube drastically changed the balance of the weapon and thus the characteristics of the carriage.

All hopes of AGF for early production of the T5 were soon dashed. July tests of the latest version of the gun, without a muzzle brake, revealed serious problems with the carriage. Of some thirty problems, the most serious were a broken axle and cracks in the trails. As a result, representatives of AGF, ASF,

¹Letter from Ord. Research Center to ASF, Ord. Off., dtd. 8 May 1944, T-5 Hist.

²Letter from HQ, AGF to CG, ASF, dtd. 15 May 1944, T-5 Hist.

³T-5 Chron., 2 June 1944.

⁴"Memo for record," appended to letter from HQ, AGF to CG, ASF, dtd. 14 July 1944, AGF (473).

and the Ordnance Department met to discuss the future of the T5. AGF reduced their immediate requirement to 200 guns and held production of the remaining 400 in abeyance until a decision could be reached on exactly what type of gun should be produced.¹ Ordnance officers elected to design a completely new carriage.²

The problems experienced with the T5 during July 1944 are a good example of the technological pitfalls that plague the development of virtually any weapon. An error in design computation caused the broken axle; the cracks in the trails were due to poor steel. Hurrying to complete the prototypes, the Link-Belt Company used metal from the Inland Steel Company instead of their preferred supplier Carnegie Steel. It seemed that Inland steel had a lower impact value, making it more brittle than Carnegie steel. The result was cracked trails. The appearance of such problems some six months after completion of the first prototype accentuates the technological difficulties of developing weapons.

The ultimate result was a long delay in production. Instead of the Link-Belt Company's optimistic prediction of production in July 1944, production of the final version of the gun, the T5E2, did not begin until December 1944. By the time the towed gun reached Europe no one wanted it.

It is hard to understand why mounting the 90-mm gun on two wheels proved to be such a monumental task for the Ordnance

¹Letter from HQ, AGF to CG, ASF, dtd. 2 August 1944, with inclosure "Deficiencies, 90-mm Gun Carriage T-5E1 as developed during tests at Aberdeen Proving Ground, 20 July 1944," AGF (473).

Record of telephone call from Mr. Martin, Link-Belt Co., to Gen. Wells, Ord. Dept., dtd. 25 July 1944, T-5 Hist; and T-5 Chron., 31 October 1944.

Department. Over two years elapsed before the weapon entered production. Perhaps a lack of emphasis from senior Ordnance officers contributed to the delays. The T20 series of tanks was a matter of almost daily concern to Barnes but he paid little attention to the T5.¹

Another significant aspect of the controversy over the T5 is the absence of officials of Tank Destroyer Center as vocal participants although the T5 was the replacement for the M6 3-inch gun in TD units. When the M18 was standardized in early 1944 the Tank Destroyer Command had lost most of its interest in new developments. The M18 was the ideal tank destroyer to the men at Fort Hood. They expected that this would be proven in combat. So far as they were concerned, there was no need to go further, and they spent their time refining what they had. The Tank Destroyer Command tested the T5, but its intense interest in development was gone. It was probably just as well because AGF needed no help from Fort Hood to find fault with the Ordnance Department.

AGF fought still another major battle with the Ordnance Department and War Department during the summer of 1944. An Ordnance proposal that had appeared in January finally died on 18 August when Maxwell ruled that no test platoons of T25's and T26's would be sent to NATO. This idea had appeared in a letter from Barnes to Devers. General Barnes mentioned possible tests

¹The T20 Chron. shows frequent references to Barnes's participation as does the "Activities of Maj. Gen. G.M. Barnes," OHF. The latter source is nearly devoid of references to the T5 as is the T5 Hist. A Major S.F. Mussleman seems to have been in charge of the T5.

of the T23, T25, and T26 tanks in NATO.¹ Worried about getting larger production orders for the T20 series, Barnes apparently believed that combat tests would establish a larger demand. Barnes was sure that tankers would be enthusiastic about the new equipment if they saw it demonstrated in combat. General Devers was the obvious choice for the enterprise, since he had been instrumental in obtaining the first large production orders for T26's. Once again, Devers did not disappoint Barnes. On 17 February, Devers requested the War Department to send enough T23's and T25's to equip platoons or companies, and one T26.² He also wanted to know how soon the tanks would be available. General Campbell wired on 6 March that five T23's, five T25's, and one T26 would be available about 1 April.³ After Devers' encouragement, Campbell proposed to ASF on 13 March that the tanks with an accompanying technical team be made available to NATO.⁴ On 14 March, AGF disagreed. No service board had tested the tanks and it was, "...not known whether they are fightable and fit for combat." AGF did agree to expedite service tests. If the tanks proved to be "generally satisfactory for combat," it would go along with Campbell's idea. "This headquarters," AGF also remarked,

¹Letter from Barnes to Devers, dtd. 31 January 1944, T20 Hist.

²Cable from Devers to Campbell, dtd. 17 February 1944, copy in T20 Hist.

³Cable from Campbell to Devers, 6 March 1944, G-4 (470.8).

⁴Memo from Campbell to CG, ASF, dtd. 13 March 1944, T20 Hist.

"does not view with favor the idea of making any combat zone a testing agency."¹

General McNair's policy was that even after a piece of equipment proved capable of performing the function for which it was designed it must still be reliable enough to withstand the rigors of combat without excessive maintenance. He adhered to this standard, "battleworthiness," throughout the war. In addition, AGF steadfastly supported the principle that no equipment should be issued to theaters until it was tested in the United States and met AGF's "battleworthiness" standards. General McNair was determined that no "...ground soldier be exposed to the unnecessary hazard of using unproved equipment, however promising it might look."²

Pending clearance from AGF, Somervell stopped the shipment of the new tanks on 31 March. He wrote:

This Headquarters favors the early introduction into combat theaters of new equipment and particularly that involving long production cycles.../But before such equipment is introduced into theaters, it is essential that the using force be given an opportunity to evaluate the equipment and reach a finding that it is fightable and generally satisfactory for combat as indicated by the Commander General, Army Ground Forces.³

But the idea itself was not yet dead.

After receiving notice of the shipment's cancellation from ASF on 7 April, Devers replied on 18 May he still wanted battle

¹Memo from HQ, AGF to CG, ASF, dtd. 14 March 1944, T20 Hist.

²McCaskey, Study No. 34, pp. 14-15.

³Letter from Somervell to Chief of Ordnance, dtd. 31 March 1944, T20 Hist.

tests for the T20 series of tanks.¹ Before Devers reaffirmed his request, Marshall, while at Aberdeen Proving Grounds, had directed Maj. Gen. Stephen G. Henry, New Developments Director at the War Department, to "follow up" on the T23. Henry replied to Marshall on 13 April that the T23 had entered production in March. "Theater Commanders," he pointed out, "generally have not looked with favor upon re-equipping existing units with newly developed types of combat vehicles." In addition, Henry mentioned that most of the T23's would go into storage pending service tests by a tank battalion. General Marshall annotated the memo, asking if Henry agreed with the theaters and the idea of storing 175 T23's.² His answer on 17 April expressed his agreement with not sending untested equipment overseas and storing T23's until tests were completed. Relating a conversation with the AGF commander Henry stated that: "I have personally talked to General McNair...and he is of the opinion that the T23 in its present form should not be shipped to an active theater. In this I fully concur."³ Maj. Gen. Thomas T. Handy, head of the Operations and Plans Division (OPD) discussed the subject with Henry, Barnes, and Campbell. He advised Marshall on 23 April that he did not believe the T23 should be sent overseas since testing could be conducted faster in the United States. General Marshall agreed.⁴ Although the T23

¹Cable from Devers to War, dtd. 18 May 1944, G-4 (470.8).

²Memo from Henry to Chief of Staff, U.S. Army, dtd. 13 April 1944, with hand-written notation initialed "GCM", C/S.

³Memo from Henry to Chief of Staff, U.S. Army, dtd. 17 April 1944, C/S.

⁴Memo from Henry to Chief of Staff, U.S. Army, dtd. 23 April 1944, with handwritten "OK" initialed "GCM", C/S.

would remain in the United States, Marshall asked Devers if he still wanted the T25 or T26, advising him that a platoon of T25's could be available in August and one of T26's in December.¹ General Devers reiterated his request on 6 June.²

Since Devers still wanted the tanks, Maxwell ordered Somervell and McNair on 10 June to organize and dispatch one platoon of T25's and another of T26's to NATO as soon as the platoons were available. AGF objected to the directive, emphasizing that all available T26's were needed for testing in the United States and adding that the T25 needed modifications before being shipped overseas. A representative of ASF pointed out that modifications of the T25 would require the facilities being prepared to produce T26's, thus disrupting production of the T26. General Maxwell stood firm and overruled AGF and ASF on 5 July. He directed that the T25's would come from the forty then available with only local modifications and that the T26's were to be obtained from the production line.³ Emphasizing the directive on 31 July, General Handy advised Somervell and McNair to have the platoon of T25's ready for shipment by 5 September.⁴

¹Cable from Marshall to Devers, dtd. 27 May 1944, G-4 (470.8).

²Memo from Maxwell to CG, ASF and CG, AGF, dtd. 10 June 1944, G-4 (470.8).

³Memo from Maxwell to CG, ASF and CG, AGF, dtd. 5 July 1944, G-4 (470.8).

⁴Letter from Maj. Gen. Handy, Operations Division, General Staff to CG, ASF and CG, AGF, dtd. 31 July 1944, G-4 (470.8).

Despite the vigor with which Maxwell pressed the idea of test platoons, the project had no future. On 18 August Maxwell rescinded his previous directives, citing only the status of production of the T26 and changing theater requirements. He advised Devers that he would receive T26's in accordance with his theater's priorities.¹ Probably Maxwell realized that diverting T26 tanks in December to Devers would necessarily mean taking them from Eisenhower, who had recently demanded more 90-mm guns. The decision to withhold the T25 was probably based on Maxwell's previous refusal to produce the tanks for AGF. Since the tanks were not to enter mass production there was little point in testing them overseas. Experience with the T25 and T26 at Fort Knox would indicate that Maxwell's decision was fortunate.

After receiving a request from AGF on 9 August to express what it thought the overseas tests of the platoons then being organized should encompass, the Armored Board objected strongly to the entire project. Colonel Williams noted that the Board "...could not concur in the combat test....," and flatly stated that "Medium Tank, T25E1, is so mechanically unreliable as to practically assure its inability to carry out combat missions." He noted that the T25 was "an inefficient combat vehicle" because of faulty provisions for stowing ammunition. Further, Williams pointed out the disastrous possibility of one of the tanks being captured by the Germans. Such an event had "...an excellent

¹Letter from Maxwell to CG, ASF and CG, AGF, dtd. 18 August 1944, G-4 (470.8).

chance of happening due to the vehicle's mechanical unreliability...."¹ Of course, when any new tank is sent into combat some will inevitably be captured. But waiting until the tank can be used in large numbers gives the enemy no time to capitalize on the information before the new tank can make a major impact in battle. Colonel Williams pointed out that the secret features of the T25 and T26 would be revealed months before significant numbers of the tank reached combat. Although the objections of the Armored Board did not have much apparent impact on Maxwell's decision, they were probably important to yet another dispute between AGF and the Ordnance Department later in August.

The Ordnance Department proposed on 31 August that the latest version of the T26, the T26E3 which incorporated corrections for all the deficiencies identified during the summer tests, be standardized. AGF raised several objections to standardization, primarily that no modified tank had yet been tested at Fort Knox and the tests of the original T26 were not yet completed. Furthermore, additional modifications might be necessary and thus standardization would not facilitate production.² Experience with the M18 supported this conclusion. AGF won this battle, and the T26 was not standardized as the M26 until March 1945 after service tests were completed. But standardization of the M26 did not provide a new medium tank to replace the M4.

¹Letter from HQ, AGF to President, Armored Board, dtd. 9 August 1944; and 1st Ind. from President, Armored Board to CG, AGF, dtd. 15 August 1944, AGF (470.8).

²T20 Chron., 31 August 1944.

The failure of AGF to persuade Maxwell to order production of T25's and the classification of the T26 as a heavy tank (this classification was revised back to medium after the war) left AGF with no medium tank under development, and the Sherman was becoming obsolete by anyone's standards. Of course, neither the Armored Center or AGF had ever been totally satisfied with the T20 series which was a product of the Ordnance Department's inspiration. To rectify this situation AGF decided to generate its own requirement for a new medium tank.

After coordination with Fort Knox, AGF submitted detailed specifications to ASF on 6 December 1944. While admitting that the project was long range, AGF asked that the Ordnance Department complete a design study of the vehicle to provide a basis for a conference to settle any problems.¹ Barnes's office disdainfully rejected the project, claiming that the result would be a 60-ton tank while the proposal specified no more than 45 tons.² Colby called the proposal "amateurish."³ It might have been, but Ordnance officers would not even condescend to do the design study.⁴

¹Letter from HQ, AGF to CG, ASF, dtd. 6 December 1944, 6th Ind. to Letter from HQ, AGF to CG, Armored Center, "Subject: Development of an Improved Medium Tank" (hereafter cited as "Improved Tank"), dtd. 28 September 1944, AGF (470.8).

²Letter from Research and Development Service, Ordnance Department to CG, ASF, 8th Ind. to "Improved Tank," dtd. 28 February 1945.

³Colby quoted in Green, Planning, p. 237.

⁴Memo for Record, dtd. 1 May 1945, AGF (470.8). The memo summarizes a meeting between the commanders of AGF, ASF, Ordnance, and other representatives held on 30 April 1945, where AGF complained about Ordnance's refusal to conduct the design study.

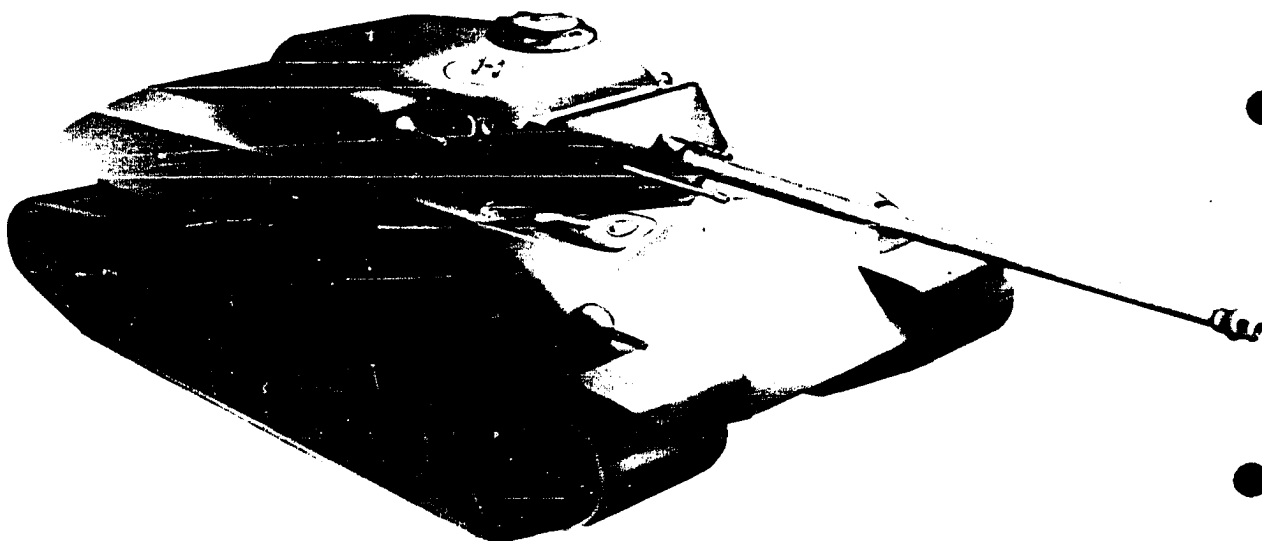


Figure 21. Artist's conception of the AGF Tank. Source: Specifications attached to Letter from HQ, AGF to CG, Armored Center, dtd. 28 September 1944, AGF (470.8).

While it is historically difficult to deal with the proposed tank without a design study, it does not seem to have been all that bad. The Ordnance reply stated that the large weight would result from "...increased bulk requirements due to the demand for increased power, cruising range and larger diameter turret ring...."¹ AGF did not specify power requirements but asked for an 8-inch armor basis and 20 MPH sustained speed. The proposed cruising range was only 100 miles but the diameter of the turret ring, 80 inches, was an increase from the 69-inch ring on the T26.² While AGF's tank was never built, the Russians managed to build a thickly armored tank with a large turret ring, the T54,

¹Letter from Research and Development Service, Ordnance Department to CG, ASF, dtd. 28 February 1945, 8th Ind. to "Improved Tank," AGF (470.8).

²Specifications of the proposed tank are inclosed with a letter from HQ, AGF to CG, ASF dtd. 8 December 1944, 6th Ind. to "Improved Tank," AGF (470.8).

which weighed only 40 tons. Some of the characteristics of the proposed tank would undoubtedly have had to be compromised, but it had a more important fault.

Like the M7, the AGF tank represented a lack of vision. Armored officers must have had the 17-pounder or German KwK. 42 in mind when they specified a gun with a maximum caliber of three inches to penetrate eight inches of armor or the equivalent thickness of slanted armor. If the Army had been willing to embark on this project so late in the war, and if Congress had been willing to fund its postwar completion, the result would have been yet another underarmed tank. It could possibly have been completed in 1948 or 1949, when its 76-mm gun would have been too small in comparison to the 100-mm Russian or 84-mm British developments of that period. In essence, the AGF tank was a heavily armored and well armed "Super Sherman." If it could have magically appeared in 1944, it would have been fine. As a long range development it went nowhere. But before the AGF tank became a matter of debate, there were still more differences between AGF and the Ordnance Department over the T26.

Disputes over the T26 between Army Ground Forces and the Ordnance Department continued when the tank finally entered production in November. To facilitate service tests and release of the T26 for overseas shipment, AGF requested on 19 October that the first twenty tanks off the production line be sent to Fort Knox. On 24 October ASF ordered the Ordnance Department to comply with AGF's desires.¹ By 8 December, Barnes was upset with the

¹Letter from HQ, AGF to CG, ASF, dtd. 19 October 1944, and 3d Ind. from Office of Chief of Ordnance to HQ, ASF, dtd. 27 January 1945, ASF.

directive because he believed that it would delay the shipment of the tank to ETO. He convinced Maj. Gen. William A. Borden, who had replaced Henry as New Developments Director in the War Department, that tanks eight through twenty-eight should be shipped directly overseas. General Borden managed to sell the idea to Maxwell. The G-4 called a meeting between himself, Barnes, Borden, and Waldron of the Requirements Section of AGF. Generals Barnes and Borden presented the Ordnance Department's viewpoint. Apparently, Maxwell had already made up his mind, and he overruled Waldron.¹ AGF received only the first seven tanks.² General Maxwell noted that the tanks were being released without AGF's approval and partially mollified Waldron by adding a member of the Requirements Section to Barnes's technical mission that would accompany the tanks to Europe.³

Barnes's trip to Europe, the Zebra Mission, was to expedite the introduction of the T26 into combat units. In addition, single items of other new equipment, including a T5E2 gun, were part of the mission.

The trip also served as a promotional effort for Barnes. Arriving in Paris on 9 February 1945, Barnes quickly made contact with representatives of SHAEF who arranged a meeting with General Eisenhower. The Supreme Commander decided to send the twenty

¹T20 Chron., 8 December 1944; and Memo from Col. Howard Bruce, Acting Director of Material, to Gen. Styer, dtd. 19 December 1944, ASF.

²Memo from HQ, ASF to Chief of Ordnance, dtd. 22 December 1944, ASF.

³Memo from Bruce to Styer, dtd. 19 December 1944, ASF.

T26's to Bradley's 12th Army Group, and Bradley's headquarters subsequently assigned them to the 3d and 9th Armored Divisions of First Army. Apparently unable to ignore a chance to vindicate the time and effort spent on the T23, Barnes managed to have this tank introduced into discussions with Eisenhower. The Commander of SHAEF referred the matter to Holly's Section. "All Commanding Generals....," claimed Barnes, "...stated they would be very glad to have these tanks with 76-mm guns...."¹ However, Colonel Dean, the representative from AGF, had a directly contrary report.² General Holly commented that, "It is unlikely that the 'Commanding Generals' referred to have a personal knowledge of the problems associated with the introduction of the electric drive T23; their expressed desires were very probably based on the 76-mm gun with which these tanks are equipped."³

Pressure for more 76-mm guns was intense by 1945. Troops and commanders agreed that they wanted no more Shermans with the 75-mm gun. Ordnance units in the theater managed to devise a way to replace the 75-mm gun in the Sherman with the 76-mm. This was the same way that the Ordnance Department had first mounted the bigger gun in the M4, and the Armored Board had rejected it in 1943. When there was no pressing need for the 76-mm gun such an

¹Letter from Barnes to Campbell, "Subject: Report of Heavy Tank Mission," dtd. 6 March 1945 (hereafter cited as "Tank Mission"), ETO.

²McCaskey, Study No. 34, p. 45.

³Letter from Holly to Deputy Theater Commander, "Subject: Comments on 'Report of Heavy Tank Mission' (Lt. General Barnes--General Campbell)," dtd. 26 March 1945, ETO.

improvisation was unacceptable. But when representatives of the Army Groups viewed the modified tank on 24 February 1945 they deemed it a "satisfactory expedient." After combat created a desperate need for a better tank-killing weapon the unsatisfactory became satisfactory. The small number of guns available and time consumed for the conversion (150 man-hours) combined to kill the idea. Only "Jumbos" received 76-mm guns because troops had learned to appreciate their thick hides and its conversion was easier.¹ Even this intense desire for 76-mm guns could not persuade General Holly to recommend that the theater should request T23's.

Despite Holly's distaste for the T23, Eisenhower required his tank specialist to study the advisability of introducing T23's into ETO. As tests of the T23 had been completed late in 1944, AGF requested on 22 November 1944 that T23's be modified to correct all deficiencies identified in these tests and tested again. AGF proposed offering two battalions to ETO or Mediterranean Theater of Operations (MTO), if the tanks proved successful. General Barnes objected on 19 December that modifying the T23 would interfere with current tank production. "Furthermore," Barnes testily commented, "the modifications would require so long a time that any opportunity to employ the tanks in this War would have been lost." He recommended sending the entire 250 tanks overseas "as is" to gain experience with the electric drive.² Supporting

¹Brent, Final Report, ETO, p. 22.

²Letter from Holly to CG, SHAEF, "Subject: Advisability of Introducing Medium Tank, T23, Into the European Theater of Operations," dtd. 15 February 1945, ETO; and Letter from Barnes to CG, ASF, dtd. 19 December 1944, 2d Ind. to letter from HQ, AGF to CG, ASF, dtd. 22 November 1944, ASF.

Barnes, Campbell recommended to Somervell on 30 December that 250 T23's be sent to MTO. General Campbell must have been embarrassed when Somervell discovered that there were only 147 T23's available for issue. The idea was killed by the Operations Division of the War Department.¹ With all of this information and a copy of the Test Board Report on the T23 which said "No" to sending the T23 overseas, Holly recommended to Eisenhower that the T23 not be requested for ETO. Eisenhower agreed on 17 February 1945.² This finally ended efforts to send the T23 overseas. While received much more enthusiastically by overseas commanders, the T26 still had faults when it arrived in Europe.

Despite AGF's efforts to test the T26 thoroughly, the tank arrived in Europe with a few technical problems. For example, when the gun was cold it would not recoil far enough to eject expended shell casings. This problem resulted because the muzzle brake, insisted on by the Armored Board to reduce blast, also reduced recoil. Ordnance engineers neglected to change the cam which operated the gun's breech to compensate for reduced recoil. Luckily, one of the technicians with Barnes was able to solve the problem in the field by filing down the cam.³ The fact that the T26 suffered relatively few teething problems in the field is a tribute to the thorough testing insisted upon by Armored and AGF officers, but only 200 of the tanks reached the troops by the end of the war.⁴

¹Memo from HQ, ASF to Chief of Ordnance, dtd. 4 January 1945, ASF.

²Letter from SHAEF to CG, ETO, dtd. 17 February 1945, ETO.

³Hunnicut, Pershing, p. 17.

⁴Brent, Final Report, ETO, p. 22.

American tankers proved to be quite happy with the T26, particularly because of its 90-mm gun. Reports of the T26 were mainly distinguished by noting how many German tanks were destroyed by the new American vehicle. General McNair was right. A big gun on a tank encouraged crews to hunt other tanks. He would have been appalled to learn that when the troops received a T26 with a special high velocity 90-mm gun the tankers immediately welded more armor on the tank and went off looking for a Royal Tiger.¹

Besides his attempt to sell the T23, Barnes also touted other projects. "All Commanders of Armored Divisions...", he reported to Campbell, "...thought that the heavy tank T26E3 represented the ideal type of tank...." After displaying a packet of photographs of new heavy tanks, the T28, T29, and T30, which were all matters of controversy with AGF, Barnes assured Campbell that the tankers were begging for the vehicles with comments such as "...T28 ...good tank..., T29...will be well received..., and T30...thought to be ideal...." Characteristically, Barnes recommended production of 500 T30 tanks (155-mmgun).² He returned to the United States in March, glowing with satisfaction. As he departed, the burning controversy over tanks began to disappear from the pages of public news and became history.

The development process had provided the tank destroyers with both the weapon that they desired and another fostered by the Ordnance Department. General Bruce had fought hard for his M18, the "ideal" vehicle for tank destroyer doctrine, and the troops regarded it highly. But the fighting men were much more

¹Hunnicut, Pershing, p. 28.

²"Tank Mission."

avid about the M36, which McNair and the Ordnance Department had forced on Bruce, because it had the firepower so desperately needed to cope with Panthers and Tigers during the Battle of the Bulge.

Towed tank destroyers died after failing the test of combat. Self-propelled ones did not long survive the former's demise. As officers of the European theater studied their combat experience after the war, they found that tanks, which had become as well armed as tank destroyers, were able to do anything that tank destroyers could. Therefore, ETO's General Board concluded that the tank destroyers' function be assumed by tanks and "that tank destroyers as a separate arm be discontinued."¹ The War Department agreed and disbanded the tank destroyers.

Development of tanks had produced more controversy than had tank destroyers but the results were less happy. Neither the Ordnance Department's nor the Armored Force's products were of any value to the men in combat. The twenty tanks that Barnes so proudly chaparoned to Europe were far too little and much too late. After wasting time on the M7 the Armored Force tried to have the Sherman adequately armed. But the Ordnance Department scorned interim measures such as the Firefly or an M4 with a 90-mm gun. General Patton probably summed up the attitude of the troops best when he told an Ordnance officer that "Ordnance takes too God Damn long seeking perfection at the expense of the fighting men and you can tell that to anyone at Ordnance."²

¹GB 60, p. 29.

²Mayo, Battlefront, pp. 337-338.

CONCLUSIONS

Stung by criticism of correspondents and tankers about the belated arrival of the T26, Ordnance officers and subsequently the official historians of the Ordnance Department sought an explanation. His steadfast and vocal opposition to production of the T26 in the fall of 1943 made the late Lesley J. McNair a perfect scapegoat. His success in keeping such tanks as the M6 and T23 off the battlefield and the acid disputes of 1944 confirmed the bitterness of the Ordnance Department. Close association with these men and their records led the official historians to place the blame for the slow arrival of the T26 on McNair and AGF. A fresh reading of the evidence suggests that the Ordnance historians were mistaken.

General McNair's opposition to production of the T26 did not delay the arrival of that tank in Europe by a single day. AGF consistently supported development efforts and approved production of ten T26's in May 1943. The nine months that elapsed before the Ordnance Department managed to build the first T26 were not the result of AGF interference. McNair's firm stand against producing extra T26's in the fall of 1943 had been overruled by Marshall only three months after the Ordnance Department first recommended production. Before the first prototype of a T26 had moved a track block, the Ordnance Department had orders for 300 of the tanks. These tanks did not begin arriving on the battlefield for fourteen months. In 1943 the tank existed only on paper. And

the original T26 had serious deficiencies that had to be ironed out during the summer of 1944 before the tank was ready for combat. AGF did not invent those deficiencies. McNair supported efforts to perfect the T26 and, in fact, came to the rescue when Campbell wanted a large production order in 1944.

Lida Mayo supports Colby's assertion that the T26 could have been ready for the landings in Normandy had it not been for McNair's opposition. This appears highly doubtful. Even taking the most optimistic viewpoint for the Ordnance position that the tanks could have been ordered in September 1943, the fourteen months that proved necessary to get the tanks to Europe would have resulted in the arrival of the T26 no earlier than November 1944. The Ordnance argument assumes that an early production order would have resulted in the rapid arrival of the T26 in combat. This assumption is not supported by experience with any other tank produced by the Ordnance Department.

Even the Ordnance Department's fastest development, the M18, does not support this optimistic assessment. The M18 had been in development nearly a year before AGF asked for mass production in February 1943. Production started in July, but by February 1944 only 103 M18's were fit for combat. And they were still in the United States. It took more than a year to get M18's to the front--and then in small numbers.

The delay in fielding the T26 was due to something far more deep-seated than the colorful dispute over production orders in 1943. It takes time to perfect major technological developments. This was true for the T26. It did not appear earlier because the engineers in the Ordnance Department could not construct a

satisfactory version of the tank any faster than they did. The only factor that might have helped would have been early and continuous participation from the Armored Board. Such coordination might have eliminated some of the T26's faults before its prototype was completed. Perhaps one or two months could have been saved. But this is not to say that the development of the T26 was exceptionally bad or slow.

The development of the T26 was a very respectable accomplishment. Only thirty-two months elapsed between the mock-up M4X and the arrival of T26's in Europe. The vaunted Panthers arrived in battle after only eighteen months but twenty-eight months transpired before the Germans considered the tank satisfactory in March 1944.

The German Army was about one to two years ahead of Americans in tank designs. That lead did not result from advances in 1942-1945. It probably resulted from developments during the interwar years. From 1935 the Germans began developing a technological base for tanks while the Ordnance Department struggled to squeeze money from a government trying to cope with the worst depression in American history. The various components that were assembled to create the Panther were under development during the prewar years. Combat experience prior to American entry into the war spurred the tank toward completion.

In contrast, the T26 was a pioneering effort for American tank designers. Its torsion bar suspension, box hull, rear drive, and torquematic transmission were all new. Some of these features, in particular the box hull and rear drive, are now present on modern tanks such as the Russian T-62 and British Chieftain. Perhaps the best epitaph for the T26 is that it is the evolutionary

base for America's M60 tanks which are standard equipment thirty years later.

But disagreeing with the official histories and defending the T26 does not address the fundamental issue. During 1944 and 1945 American soldiers found their weapons inadequate to deal with German tanks. The reason for this was a combination of two factors: doctrine and knowledge of the enemy. Doctrine dictated that American tanks should not be armed to fight other tanks. A poor evaluation of the enemy coupled with very limited experience in fighting his tanks provided no reason to change doctrine.

The failure to assess the capability of American guns to deal with German tanks lies largely with the Ordnance Department. That agency was responsible for technical intelligence. It did not discover how weak American weapons were until it was too late to develop adequate ones. The rest of the Army was equally tardy in calling for a re-evaluation. There was no significant complaint from the men in the combat zones until July 1944. Given Marshall's willingness to answer demands from his theater commanders there is no doubt that changes would have occurred if they had been requested. More particularly, the Tank Destroyer Command must share the blame for the poor assessment of German tanks. The Army's primary agency for coping with German tanks should have left no stone unturned to be positive that their weapons were adequate for the task. But it remained complacent, never questioning the capability of the 76-mm gun. As a result of its complacency only a limited number of 90-mm guns was available. Even these were not fully adequate, and none of them were on tanks which were the vehicles most often at the forefront of battle.

There had been no reason to change the doctrine that kept well armed tanks off the battlefield. The Army's first experiences in combat seemed to confirm it. Battle in North Africa appeared to indicate that guns were the answer to tanks, but the experience of battle seemed to show that those guns should not be mounted on vehicles. The Army did not learn that its tanks needed better armament until the summer of 1944. Another lesson of that summer was that the towed gun was a failure in different circumstances. This is clear illustration of the hazards of hastily drawn combat "lessons" which are so often dependent on specific terrain.

The fate of the towed gun was a part of the failure of the tank destroyer concept. When McNair had conceived the idea, antitank guns were light and easily moved, perfectly adaptable to his idea of easily massed mobile guns. Their small size also allowed them to be easily concealed and thus more dangerous to tanks which had to expose themselves to attack. By 1945 the little 37-mm gun, whose 912 pounds could be manhandled, had grown to a cumbersome 90-mm, 7,800 pound monster which was as hard to conceal as to move.

The concept was not necessarily false. Technology of the 1940's could not provide small weapons that could defeat increasingly heavy tanks at practical ranges. Technology has now provided such a weapon, the guided, antitank missile of the 1970's, and a means to give it great tactical mobility--the helicopter. In this context, McNair's concept may not be an idea whose time had come and gone but one that could not be supported by the technology available at the time.

The story of the tank destroyers is a fascinating juxtaposition of personalities, doctrine, technology, and combat

experience. At various times each of these factors seemed to be the decisive one, but invariably the remaining factors always affected results.

Initially the combat experience of the French and British forced a doctrinal change. In 1940-1941 the problem of stopping German tanks was doctrinal, not technological. In 1940 every modern army could kill a tank. The new problem was how to cope with Germany's doctrine--massed tanks. America's answer was massed, mobile antitank guns. This doctrine demanded that technology provide suitable weapons. Since technology could not immediately provide those weapons, the executors of the new doctrine were told to adapt their tactics.

Experience in North Africa forced doctrine to accept towed weapons. This event involved Bruce in a technological development effort that he did not desire. Meanwhile, he waited for technology to provide the M18 which was needed to execute his doctrine properly. Further, the enemy's technological threat was forcing him to accept the development of heavier weapons such as the M36.

Technology played a major role in the demise of the tank destroyer. Heavy German tanks forced the United States to produce heavy antitank guns. Since large caliber towed guns proved to be a failure in combat, the guns had to be mounted in vehicles which had to grow to cope with the guns. The light, fast M18, Bruce's technological solution, was clearly underarmed by 1945 and could not carry a larger gun while retaining its mobility. The remaining tank destroyer, the M36, was hardly distinguishable from a tank and just as expensive. Its only advantage was the 90-mm gun which had already appeared in a tank. In effect, the tank

destroyer became a hybrid tank, undesirable when the real thing was available. Technology could not provide adequate firepower on a vehicle fast enough to employ tank destroyer doctrine or to have any tactical or economic advantage over a tank. But technology was only part of the reason that the Army abandoned tank destroyers.

The most fundamental problem of the tank destroyer units was that they were a defensive organization in an army almost continuously on the offensive. They rarely faced the enemy they were designed to meet because the German Army had spent its offensive power in Russia as the tank destroyer units and weapons were being developed. Of course, neither Marshall or McNair could know in 1941 or 1942 how profligately Hitler would squander his Panzers on the Eastern Front. The result was that tank destroyers were eventually measured by their ability to participate in offensive actions as a substitute for artillery or tanks. Not surprisingly, they were not as good as units trained and equipped for those tasks.

Despite their deficiencies it does not follow that creating the tank destroyers was a costly mistake. Their presence on the battlefield gave the Army a large number of effective antitank guns long before those guns were or could have been available in tanks. Without tank destroyers the Army's losses to German tanks would have been worse. The costly mistake was the failure of the Army's leadership to realize that the tanks of an offensive army would inevitably be forced to deal with the enemy's armor. And it would not have required the abandonment of the tank destroyer's never tested doctrine to put a 90-mm gun in the Sherman tank.

This author is compelled to agree with Lida Mayo that the failure to provide a heavier gun for the Sherman was unfortunate. Of course, McNair was chiefly responsible for killing Gillem's proposal, but the Ordnance Department is certainly not blameless. The lukewarm attitude of the overseas commanders to the 90-mm gun was no help. Given McNair's permissive attitude toward development, it was probably unfortunate that Gillem asked for immediate production instead of development. A 90-mm turret for the Sherman might have been ready to go into production in the spring or summer of 1944 once Eisenhower finally asked for the gun.

Finally, it may be useful to make some assessment of the involvement of senior commanders in the Army in the development process. As the story of tank and tank destroyer development unfolds, it is difficult to see who was in charge.

There was a definite lack of a thorough grasp of tank or tank destroyer development at the highest levels in the Army. General Marshall was aware of the serious controversy as a result of the dispute over production of the T26 in the fall of 1943. In retrospect, it may be surprising that he did not try to assemble all the interested parties and settle that important issue. But his consciousness of the need to meet the desires of the theater commanders in a global war may have made him reluctant to act on what they saw as a non-problem.

The theater commanders were little interested. Eisenhower was surprised in July 1944, though his own staff had enough information before D-Day to warn him that there might be a problem.

Few of these senior commanders were technologically-minded. Men such as Eisenhower, Marshall, and McNair had entered a mostly

horse-drawn or foot-propelled army which had done well in 1917-1918 relying on French and British technology. Their education in Army schools after the war had emphasized production rather than development. All this probably combined to make them less sensitive to technological--as distinct from industrial--problems than we are in the latter half of the twentieth century. Their subordinates were little better. That such a resourceful tanker as Ernest Harmon--who believed that firepower was the first priority of tank design--was not curious enough to conduct his own firing tests in 1943 is symptomatic.

The problems associated with rapidly expanding a very small professional army into one capable of fighting a global war forced a very able group of generals, largely by default, to turn over the responsibility for technological development to subordinates. The expansion of the Army was so fast that the selection of those subordinates had to be based on a close, personal knowledge of their talents and abilities. The selectees were, in general, stubborn visionaries who did very well at many wartime tasks where leadership and decisiveness were more important than technological expertise. Overall, this system of personal command succeeded although it was inefficient at developing equipment. For instance, Jacob Devers' questionable decisions concerning tank development hardly tarnish a reputation based on solid achievements of organization, training, and combat command.

The high command was not aided by its decision-making process. Decisions were usually based on opinions--not on detailed analyses of facts. For example, none of the requests from ETO were supported by a detailed justification based on

factual data. Opinions ruled and those of overseas commanders whom Marshall had personally selected carried the most weight. In defense of the process, it should be noted that global war offered little time to gather information or prepared detailed studies. Even an increased use of scientific evidence would not necessarily have been a panacea. When soldiers turned a technological problem over to the scientists, the latter sometimes produced false solutions--as they did to the problem of determining the ability of American guns to penetrate German tanks. During World War II, neither scientists or soldiers were educated to communicate clearly to one another. But, in retrospect, it seems clear that the process could and should have been more systematic than it was.

The lack of concern about tank development may have been justified. After all, the US Army never suffered a major, tactical reverse because of the quality of its tanks or tank destroyers. The Shermans and M10's usually had numbers, airpower, and superior artillery as allies. General Devers was right--the Sherman did the job. We won the war with the M4. But in Northwest Europe in 1944 and 1945, particularly in the snowclad forests of the Ardennes, the American citizens who manned the Army had to pay in blood for the Army's failure to provide them with better weapons.

SOURCES

I. Essay on Sources

This short essay is intended to help researchers. It will attempt to do two things: identify the most productive sources and specify which ones are most easily available for general research.

Magazines and newspapers are not very productive sources for information on the development of tanks and tank destroyers. Old technology is of little interest to most readers of periodicals, and practically all of the information on development was classified until after the war. Caution is always in order while consulting newspapers for technical information. Correspondents and columnists often make errors in this area. Of course, the controversy within the Army hardly ever appeared in print because soldiers of that day loathed washing their dirty linen in public. The best guide to find technical information is the Industrial Arts Index (now Applied Science and Technology). Air University Index is good on all military topics but starts in 1947. Most of the articles found by using these guides to periodicals only provided background for the organization of Army research and development. If the guides to periodicals prove fruitless one can always consult Armor (formerly the Cavalry Journal), the most consistent source for tank development.

Most of the men involved in development did not become famous and information about them is scarce. Who Was Who in American History--the Military is a convenient and valuable

reference for background on these individuals.

The official histories remain the best and most complete sources for tank development which are easily available. Constance McLaughlin Green's Planning the Munitions of War (full citations follow) is good for general background on development but Lido Mayo's From Beachhead to Battlefront is more complete and objective about the controversy. Her footnotes provided a starting point for this author's research. To balance the official histories one can consult G. MacLeod Ross's memoir The Business of Tanks. Major D.L. McCaskey's The Role of Army Ground Forces in the Development of Equipment should be available through inter-library loan from most Army libraries such as the Command and General Staff College Library at Fort Leavenworth, Kansas. Another of AGF's studies, History of the Armored Force, Command and Center, is useful for both the history of the Armored Force and the role of that organization in developing equipment.

Information on tank destroyers is much harder to find. Kent Greenfield's and Robert Palmer's brief discussions in The Organization of Ground Combat Troops are the only sources that one might find in most libraries. The best single source is Lt. Col. Emory A. Dunham's Tank Destroyer History which is another of AGF's studies. After that, one must travel to Carlisle, Pennsylvania, to consult Andrew D. Bruce's papers. This collection contains letters and documents of a military nature for the period 1941 to 1945. It is invaluable for Bruce's disputes with the Ordnance Department and offers many insights into the Tank Destroyer Command's first two years. Operational history of the tank destroyers can be pieced together from the Army's series on

World War II, e.g., H.M. Cole's The Ardennes. Committee 24's Employment of Four Tank Destroyer Battalions in ETO supplements the official histories.

Most of the information on the development of tanks and tank destroyers rests in the National Archives. The records are filed according to the War Department Decimal Filing System which is published as a book and usually available at libraries which are federal repositories. The appropriate file number for any military topic can be extracted from this little volume if one cannot visit the Archives and must correspond for information.

The records of AGF, ASF, the War Department's G-4, and the Ordnance Department, all in the National Archives, were the most productive sources. However, they are difficult to use because no single agency kept a complete file of all basic letters with all of their indorsements. Often, the files of an agency contain only the indorsement of that agency, which usually makes little sense by itself. The files of all the agencies involved sometimes have to be consulted to piece together the chain of indorsements. In some cases an indorsement, or even the basic letter, cannot be found. The "memo for record" annotation on some letters will partially compensate for this. The G-4 files offer the best chance to find a complete record to include a basic letter with all of the following indorsements. AGF records are the worst with regard to this.

The records of AGF do contain informal, interoffice memos which give valuable insight into the thinking behind decisions. This information is often absent in the formal letters that resulted. The "Foreign Observer" records of AGF's G-2 are chronologically arranged, and an index accompanies the files.

Fortunately, AGF's records on tanks (470.8), guns (472), and gun carriages (473) survived the transfer to the National Archives without being scattered. Use of the file numbers yields virtually all of AGF's correspondence on the topics mentioned. The official histories and AGF studies also reflect the file numbers in their footnotes, and this fact provides ready access into AGF's records for a wide variety of subjects.

ASF's records are not so easily used. Correspondence about a particular topic, e.g., tanks, is scattered about the Records of the Adjutant General's Office (RG 407). Aid from the archivists is mandatory, and, fortunately, they have some finding aids. The effort is worthwhile since the indorsements in ASF's files almost always have an excellent "memo for record" annotation.

The records of the Ordnance Department are the best single source but must be supplemented by the records of the other agencies mentioned. An index entitled "Research and Development" is an excellent finding aid but available only at the Archives. The Ordnance Department collected documents into easily used sources such as the History of the T20 Tank which has a chronology, best described as an office journal, followed by a selection of Ordnance Committee Items and letters related to the vehicle which, however, are incomplete thus forcing the researcher to look elsewhere, i.e., AGF, ASF, or G-4 records. In addition to documents, the Ordnance records contain several historical monographs. The Minutes of the Ordnance Technical Committee are a valuable source but have only a chronological index. The easiest way to use the minutes is to work backwards. Find the last item (the title of the individual documents) concerning a specific piece of

equipment. That item will have references to all previous items that pertain to that piece of equipment. The Ordnance Committee Minutes primarily reflect decisions and rarely reveal any controversy or provide sufficient background when used alone.

In summation, there is very little information readily available in libraries. However, the official histories are a good starting place for research.

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APPENDIX I

TECHNICAL EXPLANATION¹

United States Tank Classification

United States tank classification was originally in terms of approximate weight: 15 tons--light, 30 tons--medium, and 60 tons--heavy. Although this general scheme of classification did not change, weights varied widely for different types of tanks, e.g., 9-24 tons for light tanks. As the war progressed, classification gradually came to indicate function rather than weight. Light tanks were used for reconnaissance purposes. Medium tanks were used as the main equipment for armored divisions, i.e., to exploit breakthroughs. Heavy tanks were envisaged to serve as infantry support tanks, but, since the United States produced almost none of these tanks, mediums actually filled this role in battle. In effect, light tanks served a limited role while medium tanks became general purpose tanks. Foreign nations' classifications were similar to those of the United States although their terminology sometimes differed.

United States Tank Designations

When design of a tank started it was given a "T" (test) number, e.g., T26. After prototypes for the tank were tested by the Ordnance proving ground for engineering purposes they were

¹Information in this explanation was compiled from Chamberlain, Tanks, passim, and Senger and Etterlin, German Tanks, passim.

tested by the service board of the branch of the Army that had primary interest, the "user," i.e., the Armored Board. The Boards tested the tank for tactical suitability and suggested any necessary modifications. If the Army felt the tank was needed, and, if it had proved satisfactory during its tests, it was standardized. This meant that the War Department approved the tank for production and issue to Army units. After standardization, the tank received an "M" (model) number which was not always the same as the "T" number. For example, the T6 became the M4. Modifications of the standard tank were indicated by an "A" suffix, for example, the M4A3 was the M4 with a Ford V-8 engine. Lesser modifications sometimes called for an "E" suffix, for example, the M4A3E8 was the M4 with Ford engine and horizontal volute spring suspension. Adding to the confusion, different types of guns in any given tank did not necessarily get an "A" or "E" suffix. For example, if an M4 carried any gun besides the 75-mm this was indicated in parenthesis /M4 (76-mm)/.

United States Tank Names

Names for tanks came from the British and were never official in the United States Army. However, American soldiers and correspondents commonly used the British names, e.g., Sherman, Grant, Stuart.

Tank Destroyers

The name tank destroyer applied officially only to the organization. The vehicles were properly called Gun Motor Carriages but commonly referred to as tank destroyers or "TD's." Some correspondence uses the confusing term "towed tank destroyer"

which refers to a towed gun. The system for applying "T" or "M" numbers was the same as that for tanks. One confusing fact is that model and test number were designated for every type of equipment independently of other types of equipment. For example, there was an M6 heavy tank, an M6 gun motor carriage (the Fargo), and an M6 3-inch gun. The system would have allowed an M6 90-mm gun and M6 76-mm gun. Tank destroyers also received British names, e.g., Wolverine for the M10, but these were rarely used by Americans.

United States Tank and Tank Destroyer Guns

The most common gun used on United States tanks was the 75-mm, which was designed to fire ammunition for the American version of the French "75" of World War I fame. A lighter version of the 75-mm made possible by improved metallurgy was fitted to some light tanks. They used the same ammunition but were different guns. In addition, the 75-mm pack howitzer was adapted for use in armored vehicles but it could not fire the ammunition used in the 75-mm gun.

Tank destroyers were most commonly equipped with the 3-inch gun, an adaptation of a prewar antiaircraft gun. A lighter version of the 3-inch gun, the 76-mm, had the same projectile and had the same performance but used different ammunition. The 76-mm gun was fitted in some TD's and Sherman tanks.

The 90-mm was also an adapted antiaircraft gun. However, since it was a later design than the 3-inch gun and had already used improved metallurgy, no light version was built. The Ordnance Department built and tested several high performance versions of the 90-mm, but none were numerically important.

A lightweight version of the 105-mm howitzer used by paratroop units was adapted to fit tanks and employed in combat mounted in M4 tanks. Howitzers are low velocity, high trajectory cannons used to support infantry. In addition, the 105-mm anti-aircraft gun was fitted to a few experimental tanks. The 105-mm gun was vastly bigger and heavier than the howitzer and the two should not be confused.

British Tank Guns

In general, the English adapted their antitank guns to equip their tanks. Terminology of British guns was confused by the use of the traditional method of naming a cannon according to the weight of the projectile. The 2-pounder (40-mm) was approximately equivalent to the American 37-mm gun and, like the American gun, was obsolete by 1942. Replacing the 2-pounder, the 6-pounder entered service in 1942, and the United States adopted the gun, naming it the 57-mm antitank gun. British tank and antitank guns lacked high explosive ammunition, a severe tactical disadvantage. Therefore, much impressed by the American 75-mm gun, the British adapted it to fit existing 6-pounder mounts for tanks and fire American ammunition. The British used the 75-mm only in tanks and, adding to the confusion of terminology, called it the 75-mm. The best English antitank gun, the 17-pounder (76-mm), was heavier than the American 76-mm but able to penetrate thicker armor. However, the 17-pounder lacked high explosive ammunition until the last months of the war.

German Tank Nomenclature

The following translations should be helpful:

Ausfuehrung	modification
Fliegerabwehrkanone (Flak)	antiaircraft cannon
Kampfwagenkanone (Kwk)	tank cannon
Panzerkampfwagen (Pz. Kpw. or Pz.)	tank
Panzerabwehrkanone (Pak)	antitank gun
Sonder Kraftfahrzeug (Sd. Kfz.)	particular motor vehicle

German tank models were initially numbered by Roman numerals, e.g., Panzerkampfwagen IV. However, the Allies commonly used the term Mark instead of Pz. Kpw., e.g., Mk IV, and this term is habitually employed in English language books. Mark numbers do not necessarily indicate any classification of a tank or its chronological relationship to other tanks. For example, the Mk VI was a heavy tank introduced before the Mk V medium tank. Germans also used modification (Ausfuehrung) letters to distinguish tanks of the same model series. Ausfuehrung designations were usually ignored in Allied correspondence. As the war progressed, the German Army began assigning official names to new tanks. The definitive numerical designation of German tanks was their Sd. Kfz. number (Ordnance number) but this was almost never used in Allied correspondence.

The designations of the later German tanks were particularly confusing. The Tiger (Mk VIE) was introduced before the Panther (Mk V). The Tiger II (Mk VIB) was introduced after the Mk V. In addition, the numerical designations of the two Tiger tanks indicates that they were different versions of the same tank, but they were totally different designs.

German Tank Guns

German tank cannons generally used only a few calibers, but those calibers represented several different cannons. For example, there were three different 75-mm guns. The Mk IV originally carried a low velocity 75-mm gun. In 1942 the Germans fitted a 75-mm gun with a longer barrel (Kwk 40) on the Mk IV and other armored vehicles. The 75-mm Pak 40 and 75-mm KwK 40 had the same performance but used different ammunition, as was the case with several US weapons. The Germans introduced yet another 75-mm gun, the KwK 42, in the Panther tank. The KwK 42 was heavier than the KwK 40 or the Pak 40, and its armor penetration performance was markedly superior to the smaller guns.

Newspaper columnists and some of the official historians seem to be confused about the other major German tank/antitank gun, the 88-mm. They generally compare the American 90-mm to the German 88-mm without mentioning that there were two quite different 88-mm guns. The 88-mm Flak 36 (Kwk 36) was slightly inferior to the American 90-mm, but the 88-mm Flak 41 (Kwk 43) was superior to the 90-mm. However, the earlier Flak 36 was far more frequently encountered by Allied troops than the Flak 41. The tank version, the KwK 36, equipped the Tiger I. Only about 1,000 German armored vehicles (total production of the Tiger II, JagdPanther, and Rhinoceros) carried the KwK 43 while 1,350 Tiger I's with the older KwK 36 were produced. Both the Flak 36 and Flak 41 were antiaircraft guns that were employed as antitank weapons. The Flak 41 was adapted to an antitank mount, becoming the 88-mm Pak 43, but the Flak 36 was continuously employed in its antiaircraft form. Clearly, news correspondents were questionable sources for technical data.

APPENDIX II

TECHNICAL DATA

This appendix is intended to provide the reader with a reference for the technical characteristics of various American antitank/tank guns and gun motor carriages (tank destroyers).

I. Guns.

37-mm. This gun was America's standard antitank gun at the beginning of the war and also equipped various tanks and armored cars.¹

Weight (M3A1)	912 lb.
Projectile weight	1.92 lb.
Muzzle velocity	2,900 fps.
Penetration (homogenous armor in mm angled at 30 degrees) at range (yards):	
0	65
500	57
1,000	50
1,500	43
2,000	36

¹Peter Chamberlain and Terry Gander, Antitank Weapons: WW 2 Fact Files (New York: Arco Publishing Co., 1974), p. 47 and Table appended to "Agenda, Tank and Tank Destroyer Conference, Army War College," dtd. 26 January 1945, AGF (470.8), hereafter cited as Data. The table of ballistic performance notes is based on Inclosure 1, Military Attache Report No. 2473-44. The data is from firing tests in England and penetrations are based on 50 percent success against homogenous armor. In addition, the table contains the precaution that, due to variables in quality of plates, production shot, and errors in range estimation, the perforation thicknesses should not be interpreted as being exact.

57-mm. This gun was an American version of the British 6-pounder antitank gun, and the two versions did not differ greatly.¹

Weight (M-1A3)	3,053 lb.
Projectile weight	6 lb. 4 3/4 oz.
Muzzle velocity	2,800 fps.
Penetration:	
0	100
500	84
1,000	73
1,500	60
2,000	48

75-mm. This gun was used in the M3. The towed version was not issued as an antitank weapon but the weight is listed for comparative purposes.²

Weight (M1897A4)	3,007 lb.
Projectile weight	14.92 lb.
Muzzle velocity	2,050 fps.
Penetration:	
0	76
500	68
1,000	60
1,500	52
2,000	47

¹Data and Office of the Chief of Ordnance, Technical Division, Catalogue of Standard Ordnance Items, Vol. II: Artillery and Aircraft Armament, dtd. 1 October 1944, p. 167, hereafter cited as Ord. Cat. II. Data lists six different rounds for the British 6-pounder but none for the American 57-mm although their ammunition was apparently interchangeable. Ord. Cat. II states that the muzzle velocity of the 57-mm gun was 2,700 fps. and penetration of homogenous armor angled at 20 degrees was as follows:

500 yd.	3.4 in.
1,000 yd.	2.7 in.
1,500 yd.	1.9 in.

²Data and Ord. Cat. II, p. 158. The penetration data mentions the 75-mm tank gun. The reader is asked to accept the resulting small error in penetration, as it would apply to the M1897A4 gun (MV-2,000 fps.), in order to be able to compare penetration data from a single source.

3-inch. This gun equipped the M10 and also existed in a towed version, the M6.¹

Weight (M6)	5,850 lb.
Projectile weight	15.43 lb.
Muzzle velocity	2,600 fps.
Penetration:	
0	108
500	98
1,000	90
1,500	81
2,000	74

76-mm. This gun equipped some Sherman tanks and the M18. No towed version was mass produced during World War II. Projectile weight and ballistic data are the same as the 3-inch gun.

90-mm. This gun equipped the M26 tank and M36. A towed version also existed but did not become standard equipment.

Weight (T-5E2)	7,800 lb.
Projectile weight	23.56 lb.
Muzzle velocity	2,600 fps.
Penetration:	
0	123
500	113
1,000	104
1,500	95
2,000	87

II. Tank Destroyers.

M6, 37-mm Gun Motor Carriage. This was the 37-mm gun mounted on a 3/4 ton, 4 x 4 truck.³

Weight	3.28 tons
Speed	55 mph
Armor	.25 inch (gunshield only)
Armament	37-mm gun

¹Data and Ord. Cat. II, p. 169.

²Data and E.D. Stahr, ed., Artillery, an unpublished manuscript in OHF, National Archives. The muzzle velocity listed is from Data but some sources give the muzzle velocity as 2,650 fps.

³Peter Chamberlain and Terry Gander, Self-Propelled Anti-tank and Anti-aircraft Guns: WW 2 Fact Files (New York: Arco Publishing Company, 1975), p. 50.

M3, 75-mm Gun Motor Carriage. This was the 75-mm gun mounted in a half-track.¹

Weight	8.92 tons
Speed	45 mph
Armor	.25 inch (sides) .625 inch (front)
Armament	75-mm gun

M10, 3-inch Gun Motor Carriage. This was an adaptation of the Sherman tank's chassis.²

Weight	33 tons
Speed	30 mph (level) 20 mph (3 percent grade)
Armor	1.5 inches (hull front) .75-1.5 inch (hull sides) 2.5 inches (turret front) 1 inch (turret sides)
Armament	3-inch gun Cal. .50 machine gun (antiaircraft)

M18, 76-mm gun Motor Carriage. This was the carriage which the Tank Destroyer Center desired as the ideal tank destroyer.³

Weight	20 tons
Speed	50 mph (level) 15 mph (10 percent grade)
Armor	.5 inch (hull front and sides) .75-1 inch (turret front) .5 inch (turret sides)
Armament	76-mm gun Cal. .50 machine gun (antiaircraft)

M36, 90-mm Gun Motor Carriage. This was the M10 modified to carry the 90-mm gun.⁴

Weight	31 tons
Speed	30 mph (level) 10 mph (10 percent grade)

¹Chamberlain, Self-Propelled, p. 51.

²Office of the Chief of Ordnance, Technical Division, Catalogue of Standard Ordnance Items, Vol. I: Tank and Automotive, dtd. 1 December 1944 (hereafter cited as Ord. Cat. I.), p. 42.

³Ord. Cat. I., p. 49.

⁴Ord. Cat. I., p. 51.

Armor	1.5-2 inches (hull front) .75-1.5 inches (hull sides) 3 inches (turret front) 1.25 inches (turret side)
Armament	90-mm gun Cal. .50 machine gun (antiaircraft)

III. Tanks.

M4 Medium Tank. There were many modifications to the Sherman tank, but the model number only indicated different engines as follows: Continental R-975 air-cooled radial, M4 and M4A1; twin General Motors 6-71 diesel truck engines (most of these sent to Russia), M4A2; Ford V-8, M4A3; and Chrysler multibank 30 cylinder, M4A4 (used almost exclusively by the British).¹

Weight	33 tons (M4 and M4A1), 34.5 tons (M4A2), 34 tons (M4A3), and 35.5 tons (M4A4)
Speed	24-29 mph (depending on engine)
Armor	2-3 inches (hull front depending on modifications) 1.5 inches (hull sides) 3 inches (turret front) 2 inches (turret side)
Armament	75 or 76-mm gun / tanks with the 76-mm gun were designated M4 (76-mm) 2-- Cal. .30 machine guns Cal. .50 machine gun (antiaircraft)

T23 Medium Tank. The tank used an electric drive which was unsatisfactory to AGF. The T23 had a volute spring suspension, as did the Sherman, while the T23E3 had torsion bars and wider tracks.²

Weight	33 tons (T23) and 36 tons (T23E3)
Speed	35 mph.

¹Data from Chamberlain, Tanks, pp. 115-116.

²All data on T20 series from Hunnicutt, Pershing, pp. 208, 210, 213, 215, and 217.

Armor	2.5 inches (hull front)
	2 inches (hull sides)
	3.5 inches (turret front)
	2.5 inches (turret side)
Armament	76-mm gun
	2--Cal. .30 machine guns
	Cal. .50 machine gun (antiaircraft)

T25E1. The T23 modified to include a 90-mm gun, torquematic transmission, and torsion bar suspension.

Weight	35 tons
Speed	30 mph
Armor	3 inches (hull front)
	2 inches (hull sides)
	3 inches (turret front)
	2.5 inches (turret side)
Armament	90-mm gun
	2--Cal. .30 machine guns
	Cal. .50 machine gun (antiaircraft)

T26 Medium Tank. The T26E1 was a more heavily armored version of the T25E1. The T26E3 included modifications made necessary by service tests and was standardized as the M26.

Weight	40.5 tons (T26E1) and 42.5 tons (M26)
Speed	25 mph
Armor	4 inches (hull front)
	2-3 inches (hull sides)
	4 inches (turret front)
	3 inches (turret side)
Armament	90-mm gun
	2--Cal. .30 machine guns
	Cal. .50 machine gun (antiaircraft)

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